The American Journal of Surgery

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EDITORIALS

1936

A NEW year and a new volume begin with this issue of the American Journal of Surgery. The future appears bright. A full supply of articles of exceptional merit is on hand. We desire to teach the practical side of surgery. We realize that the majority of our readers are men, although far from any large medical centers, desiring information that will aid them in their everyday practice. It has been said that if an issue would be read from cover to cover, that issue would be poor. Every man is not interested in research problems and experiments, or special branches, as obstetrics, urology, orthopedics, thoracic surgery, or gynecology. But every one who does surgery is interested in one or more subdivisions. And this Journal is planned for that man.

The Journal will remain independent, and not be influenced by cliques, individuals with an axe to grind, or publish articles because it is the official organ of a society at which the paper was presented. Articles are judged solely on their merits.

In the last decade the American Journal of Surgery has gone a long way and has taken its place with the outstanding, quality publications of this country and abroad.

Our aim is to continue serving the profession, educate the physician and help raise the standard of surgical practice.

We would welcome your suggestions and criticisms.

Our kindest wishes for 1936 are extended to you.

T. S. W.

THE AIMS AND FUTURE OF PLASTIC SURGERY

THE art of remoulding malformed, maimed or defective parts of the human body is not of modern origin. Celsus, in the seventh volume of his book, "De Medicina," described in detail methods of correcting de-

formities. But the origin of plastic procedures dates probably from the Brahmin times in the sixth century B.C. Galen, Paulus of Aegina, Antyllus, the famous Branca family in Sicily, the Vianco family in Calabria, and many others were contributors to this fascinating field in the Middle Ages. The modern viewpoints in this type of surgery go back to some extent to Tagliacozzi in Bologna in the sixteenth century, and preeminently to von Graefe and Dieffenbach in the early nineteenth century.

When surgery entered the modern period, the era which we are wont to term that of antiseptic and aseptic technique, plastic procedures had their first real chance for success. Infection and sepsis have always been the dreaded foes of the operator; and yet, with this adversary conquered, the plastic art did not make the forward strides which a careful student of medical history might have expected. The entire practice fell, more or less, into disrepute. The title of "plastic surgeon" was derided and ridiculed in a manner reminiscent of the barber surgeons, we might even say deservedly, for the domain had been invaded by the cosmetician and the charlatan. But gradually we are facing the situation with open minds and seeing eyes. Are we to permit the exclusion of this important and truly scientific branch of surgical endeavor from the quest of aid-seeking and deserving patients because imposters and mountebanks have brought the plastic methods into disrepute?

Many surgeons, well qualified by both experience and judgment to carry out plastic operations, have studiously eschewed them to avoid the epithet of "plastic surgeon." This stigma will disappear as soon as we are able to definitely set the indications for plastic methods. William Beck divides plastic operations into two main classes for the purposes of indication. He terms one the "cosmetic plastic," and the other the "reconstructive plastic" procedure. The former he defines as "any surgical procedure which transforms one *normal* anatomical structure into another *normal* form." An example of such a procedure would be the remoulding of a Roman nose into a Grecian model. The "reconstructive plastic" is defined as "the transformation of an *abnormal* anatomical structure into a more normal one." This group he further subdivides into the "structural reconstructive plastic," and the "physiological or functional reconstructive plastic." An example of the former of these two subdivisions, which in turn illustrates the entire group, would be the moulding of a saddle nose into a normal form. The latter of the two subdivisions is exemplified by the operative procedures aiming at the correction of a Dupytren's contracture or a burn-scar contracture in the axilla.

A careful study of the individual case will permit its classification in the manner indicated. When this has been done the determination of the indication will be simplified. One often sees a patient who desires the alteration of a normal organ for some imaginary defect. Vanity and style will fill the offices of the tissue sculptor. But careful delineation of the semiology will save the reputation and integrity of the profession.

Plastic surgery should not be arrogated to the quack. It is a surgical specialty which should be attempted only by those who have had more than adequate training in general surgery, coupled with technical skill and an artistic temperament. To attempt this difficult and exacting work, requires a man of special training in the intricacies of its arduous technique. An adequate armamentarium is needed, and the principles of aseptic surgery must be rigidly enforced. A decided talent and a genuine love for this type of work is an absolute prerequisite if good results are to be obtained. When the structural reconstructive problems are in the hands of men qualified for the work, we will see real progress, and we will witness the advent of this specialty to the status which it *should* now enjoy.

Unhampered by the inroad of social considerations into scientific endeavor, physiological reconstructive plastic surgery has advanced and prospered. The reconstruction of function in paralyzed limbs by the transplantation of muscles and tendons has made marvelous strides. The lengthening of bones is becoming an accepted procedure. The autotransplants of toes for missing fingers is aiding the function of the mained.

The field of experiment which, however, seems most promising of the brightest future is the plastic procedure applied to the dysfunction of organs. Reported at the last meeting of the American Heart Association by Claude Beck, were the interesting experiments and their clinical application in augmenting deficient coronary blood supply by the creation of an artificial collateral circulation, by the implantation of pedicled flaps of the pectoralis major muscle into the myocardium. Similarly, the function of the endocrine glands has been stimulated by altering the blood supply, as in splanchic-nerve section in pancreatic island disease, carried out by DeTakats. These examples simply serve to suggest what the future may hold in this type of physiological reconstructive surgery.

It must be the aim of the profession to standardize these methods and select those of clinical value. Theoretical discussions and experimental research will play a paramount part in the future development of plastic endeavor. The recent success of Alexis Carrel and Colonel Lindbergh in maintaining the vitality of a human organ in vitro may add new possibilities to functionally reconstructive surgery. Thirty years ago, when Carrel was associated with me, we began to experiment in vessel suture and organ transplantation. At first this was done in a very crude way, but it led the genius of Carrel to make a series of wonderful experiments at the Chicago University, in the physical laboratory of Professor Stewart, whose kindness and assistance made it possible to make some of the most complicated experiments of transplantation of organs. It was here that Carrel was able to perform successfully the marvelous transplantation of a whole extremity of a dog. At that time we discussed the possibility of doing similar experimental work on the human body. With youthful enthusiasm we dreamed of attempting heteroplastic organ transplantations on soldiers fighting in a Balkan War which was raging at that time. Unfortunately, or perhaps I should say fortunately, we were not granted permission for this work by the governments in conflict. But Carrel's recent experiments have reawakened this dream.

Twenty-five years ago I transplanted an ovary from one patient into a woman who had had a bilateral ovarectomy. The menstrual function returned, but only for a short time. The experiments of Stone and his co-workers show that a heteroplastic transplant of tissue is possible and functionally successful.

Just as Landsteiner has demonstrated why different types of blood are physiologically incompatible, we will some day learn the wherefore of tissue incompatibility. And when research has solved this problem, undreamed-of possibilities will be open for physiological reconstructive surgery.

What are the aims of plastic surgery? To attain recognition as a truly scientific and absolutely honest specialty, practiced by preeminently skillful, qualified and honorable members of the medical profession. And the future? Immeasurable in its possibilities.

Carl Beck.

THREE CENTS A DAY FOR HOSPITAL CARE

IN the July issue of this Journal we published an editorial, "Hospitals Should Not Practice Medicine," in which we outlined the so-called "three cents a day plan," and insisted that a hospital or corporation can not and should not practice medicine.

We thought we explained the details of this "plan" in such a manner as to convey the impression that the "plan" was excellent, and also tried to warn hospital boards or superintendents, if there be any who needed such warning, that they must live up to the letter and spirit of the law, and accept only such patients who have private physicians, and that only a licensed physician is permitted to interpret an *x*-ray film or a laboratory report.

Individuals from various parts of the country wrote asking permission to republish and distribute the editorial. On the other hand, several letters stated we misrepresented the facts and placed the "plan" in a bad light.

Rather than give a wrong impression of a "plan" that both in spirit and practice is excellent, we wish to say that from an economic standpoint it is the most constructive thing that has occurred for the profession in a decade. It also answers the question of cost of illness and hospitalization for the group, loosely referred to as "the white collar class."

Briefly, to retell the "plan":—Groups of people employed at a small salary and not the usual free clinic type, may have this form of insurance at a cost of three cents a day, or ten dollars a year. In case of certain illnesses or accidents, on the recommendation of a physician, one is admitted to any hospital in the "plan" group. In any given year one is entitled to three weeks' hospitalization in a semiprivate room. This also includes any necessary drugs, laboratory work-up, routine *x*-rays, operating room, anesthesia, etc. The patient must engage his or her own physician, and the fee for the professional services is a matter entirely between the patient and the physician.

It is noted that this "white collar class" is thus protected against the cost of hospital care, which is either in excess of their means or comes at an inopportune time. The cost of this protection is brought well within their ability to pay without undue stress.

In New York City, this "plan" is conducted under the name, "The Associated Hospital Service of New York," by a Board of Officers and Directors, composed of men prominent in their varied fields, and is non-profit sharing. Any surplus is donated to the United Hospital Fund, which distributes it among the numerous hospitals. We are delighted to report that to date the "plan" is working far beyond the fondest hopes of the most pessimistic.

The city, county or state, in their various institutions and free clinics, cares for the indigent and unemployed. This "plan" amply cares for those employed at salaries too small to allow for savings to meet the expense of hospitalization. There are others, however, who do not require any consideration, as they belong to a group well able to financially meet any emergencies.

The profession has been offered many "plans" ranging from State Medicine to what-not, many "isms," most of them impracticable and scatter-brained. The "three cents a day plan for the white collar class" is successfully instituted in many centers throughout the country. All physicians should know of this plan and it should be accepted throughout the entire country, for the latest analysis shows that it is the fairest and offers most possible benefits of any plan yet offered for the solution of an important economic problem.

T. S. W.

SURGICAL REPAIR OF CLEFT PALATE

WITH SPECIAL REFERENCE TO LENGTHENING THE SOFT PALATE

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THE term cleft palate is usually used to denote a congenital lack of union of any portion of the soft palate, hard palate or alveolar border and may be classified as follows:

1. Cleft of the uvula
2. Cleft of the uvula and soft palate
3. Cleft through the soft palate and posterior part of the hard palate
4. Cleft through the soft palate with extension through the hard palate to the anterior palatine foramen
5. Unilateral complete cleft palate in which the cleft extends through the soft palate, hard palate and alveolar border between the premaxilla and maxilla on one side, and is associated with unilateral harelip
6. Bilateral complete cleft palate in which the cleft extends through the soft palate, hard palate, premaxilla and maxilla on both sides, and is associated with bilateral harelip
7. Clefts extending between the premaxilla and maxilla only, which may be unilateral or bilateral and associated with unilateral and bilateral harelip.

The vascular supply of the palate in its anterior portion is from the anterior palatine artery which passes through Scarpa's foramen posterior to the incisor teeth. The posterior portion is supplied from the posterior palatine and accessory palatine arteries supplemented in the soft palate by branches from the facial ascending pharyngeal and tonsillar vessels. The importance of the vascular supply should be considered when attempting extensive operative procedures so as to guard against death of tissue from destruction of the blood supply.

CLEFT PALATE IN RELATION TO SPEECH

Perhaps the most serious effect produced by cleft palate is defective articulation. This is a grave handicap, that retards advancement in school and is a serious obstacle in business and social contacts. The ultimate goal of the surgeon should be to not only repair the palate but to obtain the greatest possible improvement in speech.

Most students of this subject agree that the chief cause of defective speech in these cases is that nearly all repaired cleft palates are too short to effectively close off the oropharynx from the nasopharynx and, in the articulation of consonants, air that should be expelled through the mouth, passes through into the nose where it vibrates in the nasal cavity and escapes through the anterior nares, imparting the nasal character to the speech. It is often noted that cleft palate patients contract the anterior nares in an endeavor to prevent air from passing through. A certain degree of closure of the oropharynx is obtained by the action of the superior constrictor muscles. Secondary causes of defective speech in cleft palate patients are irregularities of the teeth, holes in the hard palate or where the soft palate is thickened, scarred, rough and irregular.

AGE TO OPERATE

In cases of unilateral and bilateral complete cleft palate associated with hare-

lip, the operation for the approximation of the alveolar border should be performed in connection with surgical repair of the

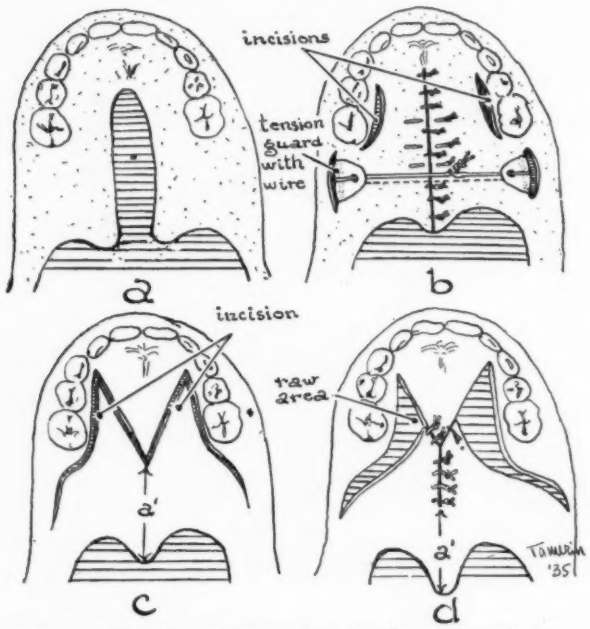

FIG. 1. Method used by author for elongation of palate where cleft extends through hard palate to region of nasopalatine foramen.

harelip as soon after birth as the child's physical condition will permit; that is, when the feeding has been stabilized and the baby shows a steady gain in weight. This may be between two and six weeks of age. At this time the bones are pliable and the alveolar border can be approximated by digital pressure and held by a silver wire which passes through the two maxillae in the canine regions, high up so as to avoid the tooth follicles. The two ends of the wire are buried under the mucosa and twisted together in the median line with sufficient tension to maintain the position that has been gained by digital manipulation. The wire should not be used to force the bones into approximation and should remain in position about four weeks. This procedure is carried out as part of the harelip operation.

The operation for the plastic repair of a hard and soft palate cleft should not be performed before eighteen months and I find that better results and a lower mortality are obtained by waiting until between the second and third year or even later. The considerations that favor operating at this time are that as the teeth erupt the alveolar process develops, the palate becomes more arched and provides more tissue to close the cleft, the palate tissues are more developed, thicker and less friable. It was formerly considered necessary to close a cleft palate before the child commenced to talk or before the characteristic cleft palate speech had been established. This, however, is a wrong premise, as cleft palate speech is dependent upon the length of the palate and whether it will function to prevent air from passing into the nose when elevated. The writer has obtained very marked speech improvement by using the posterior pillars to lengthen the palate in previously operated cases of older children and adults where the repaired palate was very short and the palato-pharyngeus muscles had thickened and developed; which effectively disproves the foregoing statement.

Before operation the general health and physical condition of the child should be favorable. The child should be free of nasal and oral infections. The winter months are ordinarily not as satisfactory for this operation, as colds and nasal infections are more prevalent and the bacterial flora is more varied and virulent, thus favoring ulceration of the raw surfaces with a resultant breakdown along the suture line.

CLEFT PALATE REPAIR

The basic procedure which gives the best results is commonly known as the von Langenbeck operation, which consists of an elevation of the tissues from the palatal vault, separation of the palate aponeurosis, at its attachment to the palate bone, paring the borders of the cleft, and suture in the median line. Modification is necessary to suit the individual case.

Favorable results depend upon recognition by the operator of several important factors:

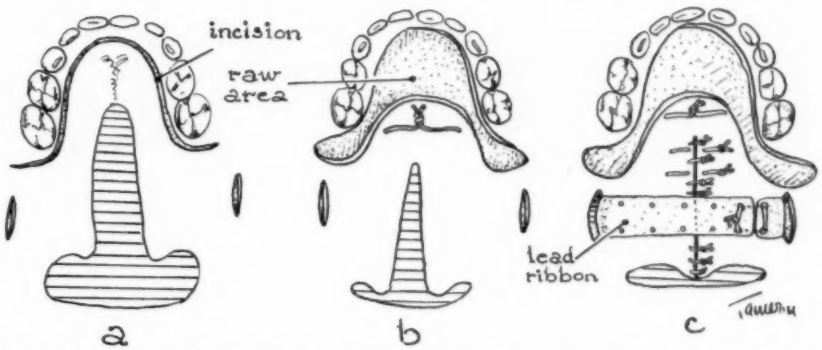

Fig. 2. "Push-back" with incision close to lingual surfaces of teeth as suggested by Dorrance.

1. Recognition and conservation of the blood supply in the preparation of flaps and the elevation of soft tissues from the bone.

2. Lateral incisions long enough to permit approximation without tension on the suture line.

3. Supplementary support of the suture line by immobilization of the soft palate and relief of tension.

4. Support of the suture line in the hard palate and relief from tongue pressure when necessary.

Surgical Treatment of Cleft Palate Involving the Soft Palate and Extending into the Hard Palate: After the borders of the cleft have been freshened, the soft tissues are elevated from the hard palate by blunt dissection, the two sides will then drop and tend to approximate in the median line especially if the arch of the palate is high. This will be further facilitated when the aponeurosis which attaches the soft palate to the palate bone has been separated and may be quite sufficient for approximation when the cleft is narrow, but all wide clefts require lateral incisions in order to relieve tension on the median line. The lateral incisions should always be made close to the teeth so as to traverse the palate external to the palatine arteries. The lateral incisions are extended well around the maxillary tuberosity so as to relieve tension at the junction of the hard and soft palate, the site where non-union and a perforation are more likely to occur.

The soft palate is sutured with fine dermal suture material, using a straight needle to produce the same contact on the nasal surface. A row of sutures is placed on the nasal surface of the uvula and posterior portion of the palate to supplement those on the oral surface.

Mattress sutures are also used in the hard palate in addition to the ordinary interrupted sutures in order to obtain a lapped approximation instead of an edge-to-edge only. Lateral incisions are also made on each side external to the palate muscles for the insertion of the author's tension relief guards.

Support of the suture line in the hard palate is advisable in case of wide clefts where the highly arched vault of the palate has been so greatly reduced as to encroach upon the space occupied by the tongue. In such instances the upward pressure of the tongue may tend to open the suture line. This is obviated by the insertion of a narrow lead ribbon or by the author's tension relief guards. This operative procedure is shown in Figure 1, B.

A cleft soft palate rarely contains enough tissue so that when repaired it will be long enough to reach the posterior wall of the pharynx and prevent the nasal character of the voice, due to air passing into the nose in the articulation of consonants. As the ultimate goal of the operation for repair of cleft palate is to secure normal speech, and as the various operations for closure of the cleft fail to attain this end in the majority of cases, experi-

enced operators, beginning with Passevant in 1862, have tried various methods to lengthen the palate or constrict the

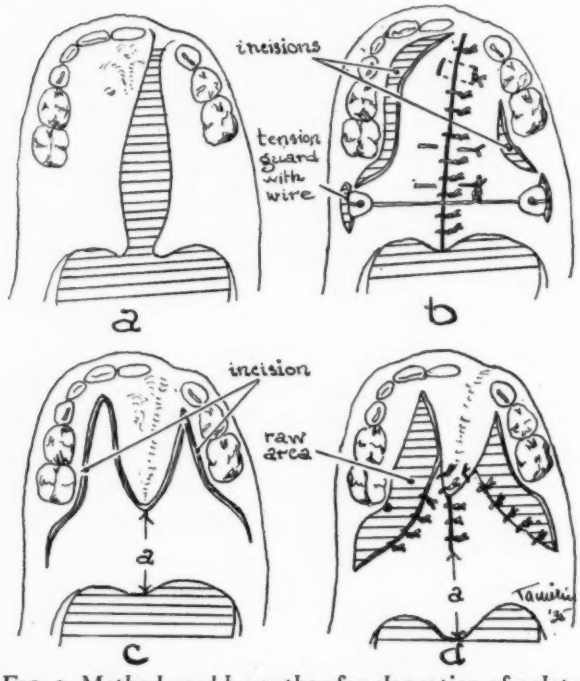

FIG. 3. Method used by author for elongation of palate when cleft extends through hard and soft palate.

pharynx and thus overcome the anatomical defect. Interest in the subject has been further stimulated in recent years following the article on "Lengthening the Soft Palate in Cleft Palate Operation" by Dorrance in 1925.

The technique now followed by the author for lengthening the palate when the cleft extends through the soft and into the hard palate, consists of a two-stage procedure; the first stage closes the cleft by the method just described. The second stage may then be carried out any time after full recovery from the first operation, though usually several weeks or even months may elapse.

Second Stage Operation to Lengthen the Palate: An incision is made opposite the canine teeth on each side and extended backward and inward to the median line, leaving a V-shaped section of tissue in the anterior part of the palate as suggested by Ganzer. Incisions are then continued from the canine teeth around the maxillary tuberosities and extended downward external to the pterygo-mandibular ligament, making a W-shaped incision as seen by the surgeon operating in the Rose position (Fig. 1, C).

The entire palate is then elevated and freed from its bony attachments. The hamular process is separated releasing the tendon of the tensor palate. If the palate is not extremely short, it can then be carried backward to touch the posterior pharyngeal wall.

The lateral sections are then carried backward and sutured to the apical portion of the V-shaped median section of the palate, as seen in Figure 1, D. The displaced tissues may also be held in their new position by wire sutures which extend through drill holes in the bone on each side, in the region of the tuberosity. The raw surfaces are covered with iodoform gauze held in position by wires which cross the palate and are attached to the teeth. This method permits of a much greater lengthening of the palate without the danger of an anterior opening in cases where the cleft extends for a considerable distance into the hard palate. Figure 2 shows a "push-back" with the incisions extending around the lingual surfaces of the teeth, as in the method of Dorrance. The distance that the palate can be pushed back is limited when the cleft extends very far into the hard palate.

The operation for lengthening the palate has been limited to incomplete cleft palate. Heretofore, when a "push-back" has been performed on a complete cleft, the patient must wear a prosthetic appliance to cover the anterior opening; but in the procedure followed by the author, all types of cleft palate can be lengthened whether incomplete or complete. In incomplete cleft palate when the cleft is wide, it is wise to close the palate by a two-stage operation. In my clinic at the Post-Graduate Hospital, we close the soft palate and as much of the hard palate at the first operation as can be done without too much risk of damaging the blood supply.

The same procedure is carried out, as previously described, for an incomplete cleft except that an additional lead ribbon or tension relief guards may be used.

After the child has completely recovered from the effects of the first operation, the anterior portion of the cleft may be closed. The usual method is to freshen the borders of the cleft on each side. An incision is then made beginning with the premaxillary side of the cleft, close to the teeth and followed around to the maxillary tuberosity on the same side. The flap thus formed is entirely elevated from the bone, beginning at the cleft border. The tissues are then elevated on the opposite side and the edge of the free flap is carried under the border and sutured into position, thus covering the defect.

A free flap may be made on each side; the cleft is then sutured and the flap allowed to fall back into position, thus closing the defect, as suggested to me by Burdick. After the cleft has been closed, whether in a single or two-stage procedure, the next step is to lengthen the palate.

A W-shaped incision is made similar to the one used for an incomplete cleft, except that enough tissue should be left to cover the original cleft, and the V-shaped section of the incision should be made with the blade at an angle of 60 degrees, on the flat of the blade instead of perpendicular to the surface. The lateral sections of the palate are then elevated, the tensor palati are released from the hamular processes, the nasal aponeurosis left attached to the posterior border of the palate bone and the palate is sufficiently separated so that it can be carried backward, without danger of lateral perforations, posterior to the end of the hard palate. The palate is then carried back, and sutured as in the operation for an incomplete cleft palate. (See Fig. 3, A, B, C, D.) This method extends the benefit of palate elongation to a very large percentage of cases that formerly could only receive the aid of closure of the cleft.

SUMMARY

The best result is obtained if the operation for the surgical repair of a cleft palate is postponed until the child is between eighteen months and two years of age, or even older. The tissues are then in better condition to withstand the necessary manipulation and the mortality following operation is much lower than when performed at an earlier age.

Early operation is of no advantage from the standpoint of speech improvement. The so-called "cleft palate speech" represents the inability of the child to prevent air from passing into the nose, especially in the articulation of consonants.

From the anatomical and physiological standpoint, the von Langenbeck procedure with modifications, is the operation of choice to close the palate cleft. The soft palate should also be immobilized by the lead ribbon or tension relief wire, as an important requirement of the operation.

The methods developed in the past few years for lengthening the velum, furnish a better functioning palate with improved articulation as an immediate result. In this connection, the procedure that retains the tissue intact covering the repaired bony cleft, offers a secure method for preventing an anterior perforation, especially as the bone is often cleft much farther anteriorly than indicated by the soft tissue defect.

REFERENCES

Burdick, C. G. Harelip and cleft palate. *Ann. Surg.*, 92: 35, 1930.

Dorrance, G. M. The Operative Story of Cleft Palate. Phila., Saunders, 1933.

Cleft palate. *Atlanta M. J.*, 31: 351, 1927, 1928.

Ganzer, H. Neue Wege des plastischen, Verschlusses von Ganmendefekten. *Berl. klin. Wchnschr.*, 54: 209, 1917.

Moorehead, F. B. The correction of secondary palate defects. *J. A. M. A.*, 90: 1614, 1928.

Vaughan, H. S. The surgery of cleft palate. *Am. Med.*, 28: (April) 1933.

RECENT FRACTURES OF THE NOSE

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FRACTURES of the nose are probably the most common fractures encountered in practice. Unfortunately, they do not receive the attention accorded fractures of other bones of the body. This negligence is twofold: (1) fractures of the nose are easily disguised by the swelling of the adjacent soft parts and hence remain undetected to the examining eye and finger; (2) fractures of the nose are considered only as minor injuries whose resultant cosmetic disfigurements are too frequently disregarded.

The cosmetic disfigurement may vary from a scarcely detectable variation from the normal nose to grotesque malformations. The frequency of ugly and undesirable deformities becomes a matter of considerable psychologic and economic import in a day and age as fiercely competitive and "appearance conscious" as this. A few years ago, doctors often rationalized their neglect in caring for a fractured nose (when something could still be done to prevent deformity) by saying that there was "little if anything to do." But since the development of corrective rhinoplasty, there is a much better understanding of the principles determining the nature and reasons for the disfigurement of the nose resulting from various types of injuries. Hence many, if not the greater number of disfigurements previously dismissed as unavoidable are now recognized as definitely amenable to treatment.

Particularly to be condemned is the neglect of a fractured nose in children, among whom it occurs with great frequency. Since plastic procedures for the correction of nasal deformities are rarely undertaken before the nose has reached its full growth (approximately the seventeenth year) any neglected deformity in children must await this full growth. The attending distress is real and of serious consequence in the child's outlook in life and his relation to associates. Hence, a badly treated nasal fracture in a child, resulting in deformity, will stand as proof of the attending doctor's neglect and incompetence.

ETIOLOGY

The most frequent cause of fracture of the nose is trauma. It is usually direct and varies from a very slight degree capable of producing a fracture in the soft bones of children to the crushing and extensive blows incident to motor accidents.

INCIDENCE

Fractures of the nose occur in all ages. They are most common during the violent athletic periods, and are incident to strenuous endeavors of all kinds. Hence they are more frequent in adolescent males and in the early twenties.

CLASSIFICATION OF FRACTURES

1. Simple Fracture
   - A. Fracture of bony bridge of nose
     1. Without deformity
     2. With deformity
        - a. Depression of bridge
        - b. Deviation of bridge
        - c. Widening of bridge

B. Fractures of septum
   1. Without deformity
   2. With deformity
      a. Depression of septum
         (1) Saddle nose
         (2) Dropped tip
         (3) Obstruction of respiration
      b. Deviation of septum
         (1) Without external deformity
         (2) With external deformity
            (a) Protruding septum
            (b) Deviation of alar cartilages

C. Combined fractures

II. Compound Fractures.

SYMPTOMS AND SIGNS

Epistaxis is a frequent sign. It is caused by the rupture of the delicate nasal mucous membrane by the bony fragments. The epistaxis may be unilateral if fracture has occurred on only one side; it may be slight and cease of its own accord, or it may be severe enough to exsanguinate the patient, unless arrested.

Ecchymosis is due to the subcutaneous extravasation of blood. The ecchymosis may be unilateral or bilateral and may differ, if bilateral, in intensity on both sides. The ecchymosis is most marked in the eyelids, and may be so severe as to shut the eye itself. The extravasation of blood may spread to the cheek and down along the neck suggesting that an injury to the face may have taken place with the fracture. The ecchymosis and swelling in most cases appears within a few hours after the injury. At times it may be deferred for almost twenty-four hours. The hemorrhage and swelling usually increase in intensity for forty-eight hours and then subside. Within ten days most of the discoloration disappears.

Swelling is due to the extravasation of blood. The nose may become very bulbous if there has been much local extravasation. In many instances there is little swelling of the nose and a great deal in the eyelids.

Impaired respiration may result either from the accumulation of blood in the nasal passages or from fracture-dislocation of the septum with swelling of the mucous membrane. A rarer cause of the impaired respiration is submucosal hemorrhage, with separation of the mucoperiosteum from the quadrilateral cartilage; this is frequently followed by infection and destruction of the cartilage with saddle of the cartilaginous bridge.

Bony crepitus can almost always be elicited by manipulation of the nose with the fingers. If the examination is deferred for a day or more, the fragments of bone will be more or less immobilized by coagulated blood. This "loose immobilization" can be reduced by gentle pressure and at the same time the extent of the fracture can be determined.

Pain is not severe in most instances. A severe crushing injury may be painless. Manipulation of the bones, in an attempt to elicit crepitus and to determine the nature and extent of the fracture, is also practically painless.

Deformity is not apparent unless the nose has been deviated from the midline or has been crushed inward. Slight deformity is frequently masked by the swelling and ecchymosis and hence is overlooked.

DIAGNOSIS

The diagnosis of a fractured nose may seem to be a very simple matter. It is amazing, however, how often the symptoms that would lead to the identification of a fracture are ascribed to a simple contusion of the soft parts. The history of an injury in the region of the nose and the eye is significant. It is generally believed that a *black eye* is due to a blow over the eye. In placing the first over the eye it will become obvious that the eye is protected by bony prominences. The lids cannot be directly struck except by a more slender instrument than the closed hand. The nose, as a bony prominence, is most easily fractured and hence receives the initial force directed at the eye. While

it is true that ecchymosis of the eyelid may be due to a contusion of the soft tissues over the aforementioned bony prominences and a spread of blood to the eyelids, nevertheless unsuspected fractures frequently accompany the ordinary *black eye*. *Bloody* nose, swelling of the nose, impaired respiration, and deformity should always lead one to suspect a fracture. Examination for bony crepitus should always be attempted since fracture without some degree of deformity is uncommon, and in the elicitation of crepitus the fractured fragments can often be manipulated painlessly into a more desirable position.

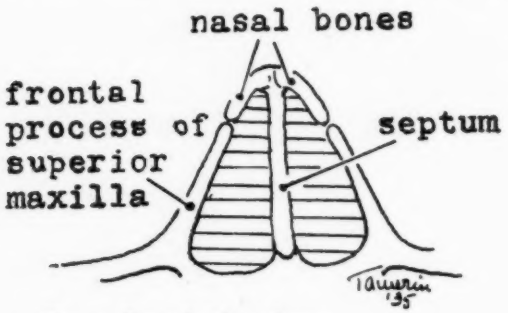

Fig. 1. Bony bridge of nose.

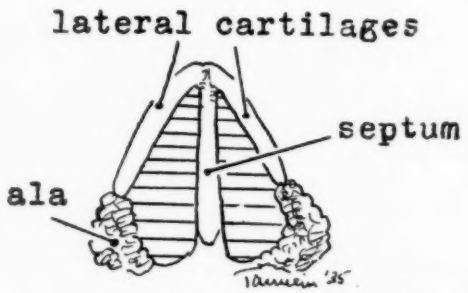

Fig. 2. Cartilaginous bridge of nose.

X-ray is frequently requested for diagnostic reasons. At best it is only an adjunct to the history and the physical findings. The plates frequently fail to reveal a fracture, or are confusing, as in the young, when the evidence from the physical findings is overwhelming in favor of a fracture.

Intranasal examination with a suitable nasal speculum and strong light is always indicated to determine the condition of the septal cartilage.

PATHOLOGY

The pathology of fractures of the nose can be best understood if one is familiar with the normal anatomical relationships.

Normal Anatomy of the Nose. For purposes of interpretation of fractures the nose may be considered as composed of a bony and cartilaginous bridge or arch. The *bony bridge or arch* is comprised of the two nasal bones and the frontal processes of the superior maxillae (Fig. 1). The cartilaginous bridge is composed of the two lateral cartilages and the two alar cartilages, supported by the septum (Fig. 2).

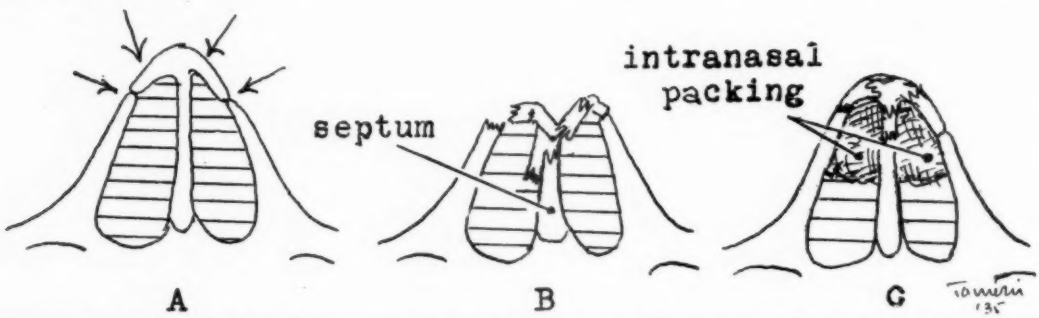

Fig. 3. Depression of bony bridge of nose. A. Arrows indicate points of fracture. B. Depression of nasal bones with fracture and telescoping of septum. C. Replacement and retention with high intra-nasal packing.

The pathology of the individual fractures will be considered under their specific treatment.

GENERAL TREATMENT

Epistaxis may be controlled in a number of ways. It may be stopped either by intranasal packing left in place for twenty-four hours or by the application of the Joseph splint on the outside of the nose, in addition to the intranasal packing. These measures

are generally unnecessary as the epistaxis is self-controlled.

Ecchymosis and swelling cannot easily be alleviated. The swelling generally reaches its height in forty-eight hours and thereafter declines, disappearing in about one week. On palpation any resistance of the swelling should suggest hematoma or infection. The ecchymosis and swelling are painless. The only discomfort, aside from the cosmetic effect, may be the glueing together of the eyelids. This can be relieved by boric acid compresses. The use of ice bags, cold instruments, etc., is without effect. If there is an accompanying subconjunctival hemorrhage of the eyeball, it may persist long after the other swelling and ecchymosis has subsided. There is no treatment to facilitate the reabsorbtion of this clot.

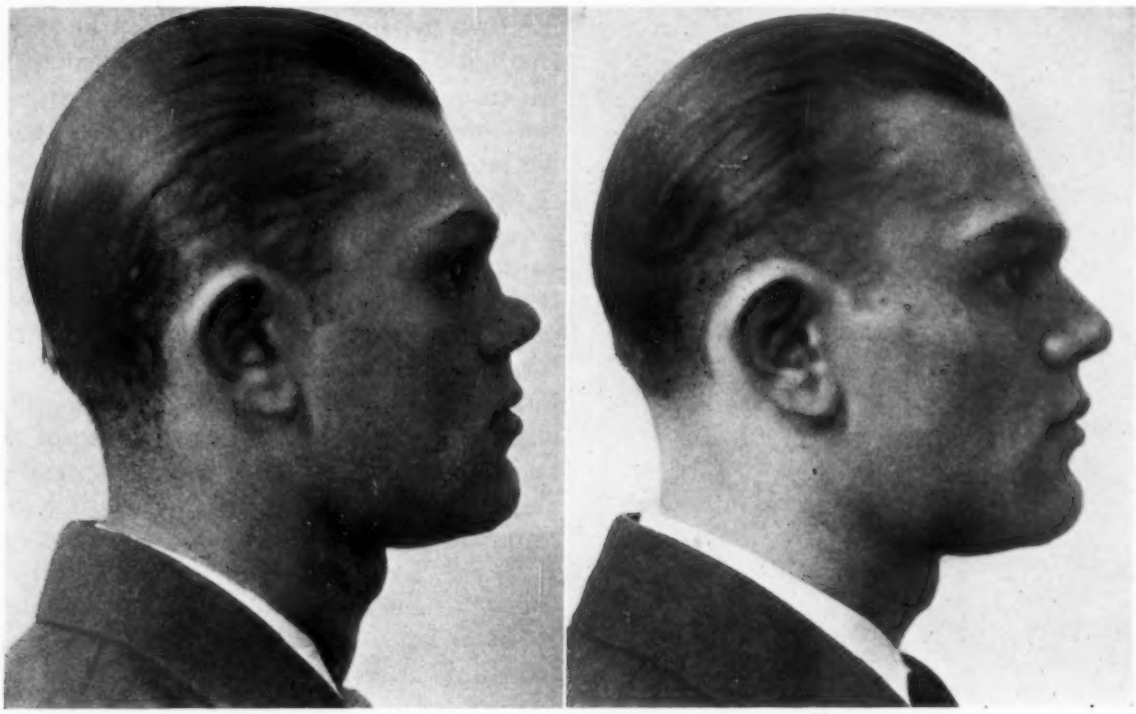

Fig. 4A. Fig. 4B.

Fig. 4. Saddle of bony bridge, traumatic, with correction by implantation of transplant (from Safian: Corrective Rhinoplasty).

Pain is generally slight and can be controlled by codeine and aspirin.

Fever does not occur unless the fracture has become infected. The intranasal blood clots and secretions can be easily removed with applicators soaked in peroxide of hydrogen. The patient should be advised to refrain from blowing his nose as it may permit the introduction of air between skin and nasal bones, causing an emphys-

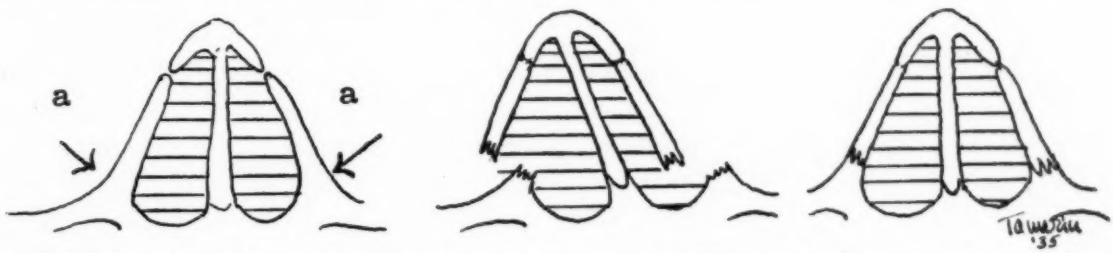

Fig. 5. Deviation of bony bridge of nose. A. Arrows indicate points of fracture (*a*,*a*). B. Deviation of entire arch. C. Replacement and fixation without external splint.

ema which is very stubborn to treatment and may persist for a few weeks.

Infection should be treated, as infections

FIG. 6. Neglected fracture-deviation of bony bridge of nose with correction by excision of triangle of bone from left frontal process. (From Safian.)

elsewhere, by wet dressings and drainage. A convenient dressing for the nose can be shaped from a 4 inch square of gauze.

PATHOLOGY AND IMMEDIATE TREATMENT OF VARIOUS NASAL FRACTURES

The treatment described below is applicable to fractures less than two to three weeks old, i.e. before fibrous immobilization of the fragments has occurred.

I. SIMPLE FRACTURES

A. Fractures of Bony Bridge of Nose

1. Without Deformity:

Pathology: Linear fractures of the bony bridge may occur without any resultant deformity. Extravasation of blood into the subcutaneous tissues producing external swelling and ecchymosis and, internally, congestion of the nasal mucous membrane and epistaxis, may be present in greater or lesser degree. Fortunately this type of fracture without deformity is the most frequent. Apparent deformity, such as widening of the bridge of the nose, is due to the swelling of the soft tissues or to a hematoma.

Treatment: These fractures may be left alone except for the treatment of the accompanying symptoms. An apparent deformity of the nose may be due to swelling of the soft parts or to a hematoma. If the former, pressure on the bridge with the fingers or the application of a nasal splint will demonstrate that the widening of the nose has not been caused by a spread of the fractured bones. The swelling will immediately recur once the pressure has been removed, it will increase up to forty-eight hours following the injury and then rapidly subside. A hematoma produces a moderately hard swelling that cannot be reduced by external pressure unless some means is provided for the egress of coagulated blood. If there is a laceration of the skin in the vicinity of the clot, the blood should be expressed through this external wound. If the clot is of considerable size and is permitted to remain, it will require many weeks for resolution. Occasionally it may organize and form a fibrous thickening. Hence, if there is no external avenue for the escape of blood, one should be made, either from within the nares (after novocaine injections) and a tract made with a sharp knife, or from an external incision. Pressure should be maintained over the region of the hematoma to prevent a recurrence; it can be maintained for approximately twenty-four hours by the use of a stent or soft metal splint.

2. With Deformity:

a. Depression of Bridge:

Pathology: Depression of fragments may produce either unsightly plateaus or sharp ridges on the bridge, or if very severe, a saddle of the bridge. When the blow is direct and sufficient to cause considerable

depression of the bony fragments there is generally a concomitant fracture and depression of the bony septum (perpendicular plate of the ethmoid) (Fig. 3).

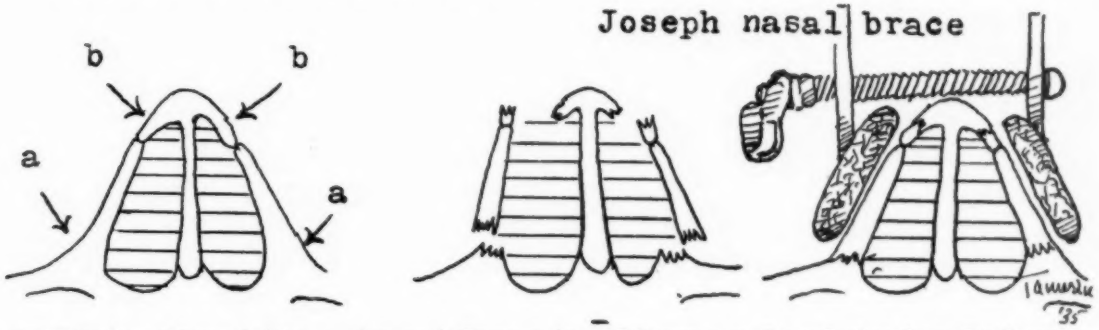

Fig. 7. Widening of bony bridge. A. Arrows indicate points of fracture. B. Spread of arch. C. Replacement and retention with Joseph or Safian brace.

Treatment: Where fractured nasal fragments are driven inward, an attempt should be made to elevate them into their former positions. The septum should be examined to ascertain whether it has been injured. If the injury is severe there may be an accompanying fracture of the perpendicular plate of the ethmoid telescoped upon itself. The nasal chambers should be cocainized and the fragments elevated with a blunt instrument. While manipulating from within the nose, one should attempt to mobilize the nasal fragments from without. With slight depressions of the bridge it is occasionally possible to restore the normal elevation of the nose and the contour of the bridge. A high packing will help to maintain the parts in position until fixation occurs, and any

Fig. 8A. Fig. 8B.

Fig. 8. Wide nasal bridge from neglected fracture with correction.

remaining sharp ridges may be filed down later. If the depression is severe little can be done to maintain the bones in their normal position. A nasal packing may hold the fractured fragments in an improved alignment. This packing should be changed daily and at best can be left in place only for a short time.

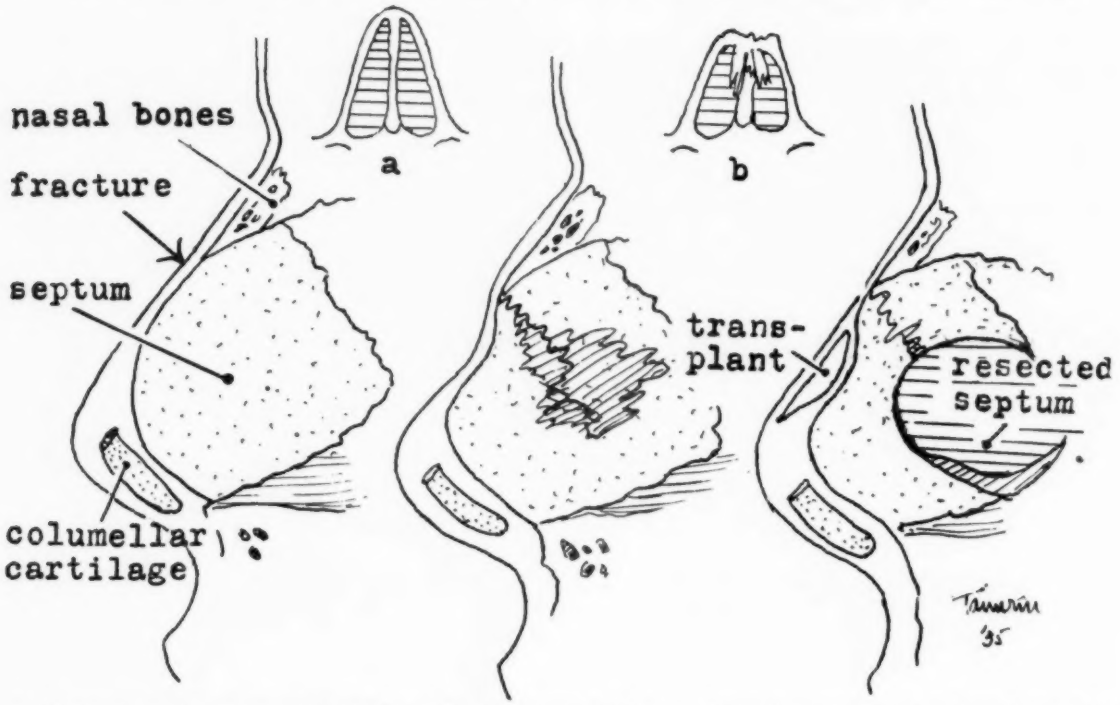

Fig. 9. Depression of septum with saddle of cartilaginous bridge. A. Normal anatomy of septum from side, *a*; from below. B. Fracture depression of septum with thickening. C. Saddle corrected by transplant; thickened septum corrected by submucous resection.

No external dressing is necessary unless there has been an injury to the skin. The Joseph nasal brace is of no value in this condition. Splints have been devised to maintain the fractured fragments in their normal alignment. They are placed in various ways on healthy bony prominences and a support is placed within the nose in an attempt to raise the bony fragments. The splints are worn until fibrous union has become sufficient to hold the bones in their normal position. Such a splint was devised by Carter. It is composed of a steel cradle which rests on the frontal processes. A hammock is strung up of strong silk from within the nose, externally, through the skin and this hammock is tied to the cradle and an attempt is made to elevate the bones by means of it. Other prostheses entail the introduction of blunt elevators into the nose which are attached externally to an apparatus permitting the raising of these elevators. We have not found these apparatuses of value. The weight and elasticity of the skin and the pull of gravity keep the depressed fragments from remaining in their normal position. The silk used in the Carter splint (aside from the objection that it permits an avenue of infection) will, if pulled tightly enough, cause pressure necrosis of the mucous membrane. The same is true of the other prostheses.

We have found that the immediate treatment of depressions of the bridge will not, in many instances, permit the restoration of the nose to its normal shape, no matter what treatment or splints are employed. Plastic correction should be undertaken on the subsidence of swelling and the saddle of the bridge (if the depression is extremely obvious) can be overcome by the introduction of a properly shaped transplant (Fig. 4).

b. *Deviations of Bridge:*

Pathology: When the trauma is unilateral there may be, in addition, a fracture-dislocation or deviation of either the fragment or the entire bridge of the nose to the opposite side. The points of fracture, when the entire bridge is deviated, are usually at the base of the frontal process of the superior maxillae. There is no widening of the arch if there has been no fracture at the apex of the bony vault, i.e., the nasal bones on both sides (Fig. 5).

Fig. 10A. Fig. 10B.

Fig. 10. Saddle nose corrected by removal of bony hump.

Treatment: No intranasal preparation for operation is necessary where the bridge of the nose is deviated in its entirety from the mid-position. One can generally reduce these fracture-dislocations without any instrumentation. In many instances no anesthesia is required. If the patient's head is grasped securely between the hands and forearms, while the thumb is placed over the convexity, a vigorous thrust in a downward and semi-circular direction will restore the nose to the mid-position. An audible click indicates that the bones have been moved and replaced in their normal position. This simple procedure may not suffice, on occasion, in children because of fear and squirming and in adults because of some pain associated with the manipulation. In these cases a light gas anesthesia or ethyl chloride inhalation will facilitate the restoration.

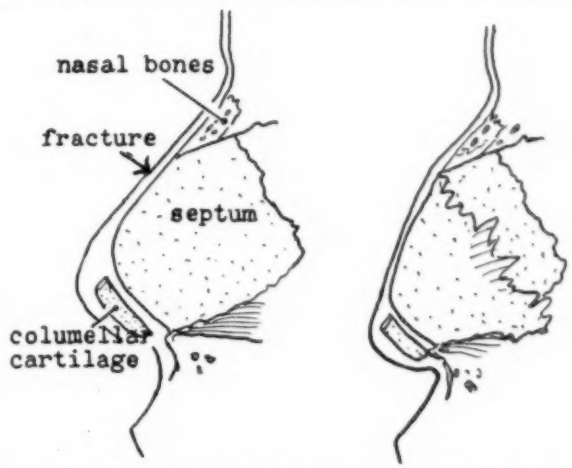

Fig. 11. Depression of septum with dropped tip. A. Normal anatomy. B. Dropped tip.

If the bone has been properly replaced, no retention apparatus is required, although a lightly applied nasal brace for a twenty-

four to forty-eight hour period will prevent excessive soft tissue swelling. This type of deformity is probably the most easily treated, since the diagnosis is obvious and the treatment in many cases simple and satisfactory.

FIG. 12A. FIG. 12B.

FIG. 12. Dropped tip corrected by shortening nose.

If the deviated bones are not immediately restored and healing takes place in an abnormal position, the attending deformity is very unsightly and requires a plastic correction (Fig. 6). This involves the removal of a wedge of bone on the concave side of the deviation.

c. *Widening of Bridge:*

Pathology: The widening of the nasal bony bridge is due to a fracture of the apex of the bony arch, so that the bones are no longer contained within their narrow limits, but are permitted to spread (Fig. 7). In the young, separation of the frontal processes from the nasal bones may occur without fracture and produce a similar widening of the bridge.

Treatment: In this condition, as in deviations of the bridge, no intranasal preparation of the patient, instumentarium or anesthesia is necessary. The bones should be mobilized externally by the fingers and then a Joseph or Safian nasal brace applied and tightened so that the bridge is made narrower.

The brace should be applied for twenty-four hours and thereafter should be worn for an hour daily until the bridge remains narrow. In applying the nasal brace it is important to be certain that the fragments of bone have been properly mobilized. If they have not, the pressure of the brace will cause necrosis of the skin with attending slough and scar formation.

This condition is frequently overlooked and leaves an unsightly bridge. If the bones are not mobilized while the fracture is still fresh, and are not maintained in a normal esthetic alignment by the nasal brace then no attempt will avail to narrow the bridge short of a plastic correction with artificially produced lines of fracture and their maintenance by the nasal brace (Fig. 8).

B. Fractures of Septum

1. Without Deformity:

Pathology: These may occur but are uncommon. Cartilage does not reunite to cartilage in a manner similar to bone repair. Fibrous union between the fragments occurs. This offers little resistance to the weight of the overlying lateral cartilages and skin, the pull of gravity, and the customary more or less vigorous handling which the nose receives in daily life.

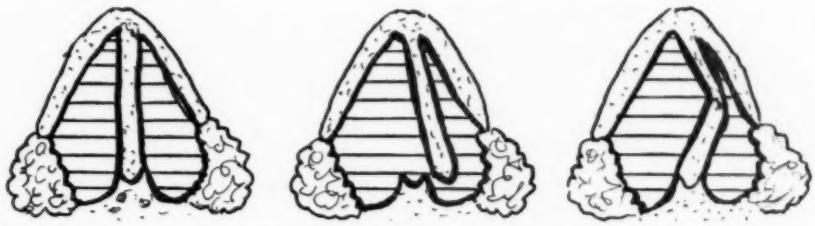

Fig. 13. Deviation of septum without external deformity. A. Normal anatomy. B. Dislocation of septum from superior palatal ridge. C. Fracture-deviation of septum.

Hence, fractures of the septum, without deformity, frequently go on to actual deformity, sometimes at a considerably later date than the original injury. Contracture of the scar is another factor in the production of a secondary deformity.

Treatment: The treatment of fractures of the septum without deformity is dependent upon the symptoms. The epistaxis should be controlled, where necessary by the use of intranasal packing. Where a hematoma of the septum forms causing a separation of the mucoperichondrium it is advisable to drain the hematoma under sterile conditions after having cocainized the nasal mucous membrane. The mucous-membrane flaps should then be maintained flat against the septum by the use of intranasal packs. A complete collapse of the end of the nose often occurs in abscess of the septum. It must therefore be zealously avoided.

2. With Deformity:

a. Depression of Septum: Saddle nose, dropped tip or obstruction of respiration may result from fractures with depression of the septum.

(1) Saddle Nose:

Pathology: If the septum has been fractured at the junction of the quadrilateral cartilage and the tips of the nasal bones, with depression of the septal cartilage, a saddle of the lower half of the nose will result. This may vary from a scarcely noticeable depression to a marked and unsightly hollow.

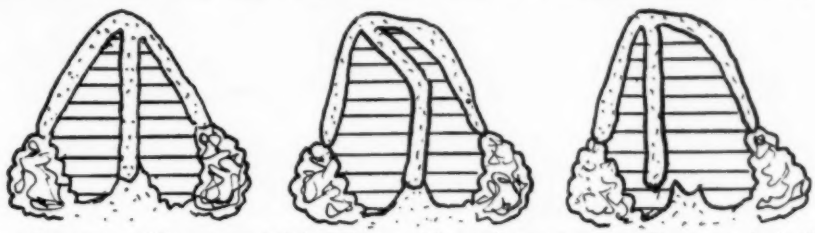

Fig. 14. Deviation of septum with external deformity. A. Normal anatomy. B. Fracture-deviation of septum with deviation of cartilaginous bridge. C. Dislocation of septum with deviation of cartilaginous bridge.

Treatment is of little avail in the immediate correction of a recent fracture of the septum with an accompanying saddle of the cartilaginous bridge. It is best to advise the patient that not much can be accomplished until the swelling has disappeared when the saddle can be effaced by the introduction of a suitably shaped transplant (Fig. 9) or by the reduction of the bony hump (Fig. 10).

(2) Dropped Tip:

Pathology: If the septum has been fractured and depressed in its anterior margin, the tip which it supports will come to occupy the new level of the septum

(Fig. 11). This dropping of the tip may become so severe that it may almost touch the upper lip and (even in the absence of

Fig. 15A. Fig. 15B.

Fig. 15. Fracture-dislocation with deviation of lower two-thirds of septum. Correction.

an obstruction to respiration due to the fracture or the septum) seriously impair the normal inflow of air into the nares.

Treatment: The treatment of fracture-depressions of the septum with dropping of the tip is likewise attended by few satisfactory results. Attempts may be made to elevate the fractured septum by means of a smooth Asch forceps, but the pull of gravity and the weight of the skin and lateral cartilages all tend to cause a recurrence of the deformity. The patient should be advised that the success of immediate treatment is dubious and informed that a future plastic correction may be necessary. This can be performed when the swelling has subsided. The plastic correction consists in either the shortening of the septum and the attachment of the tip at a higher level (Fig. 12), or the introduction of a strut in the columella to support the tip.

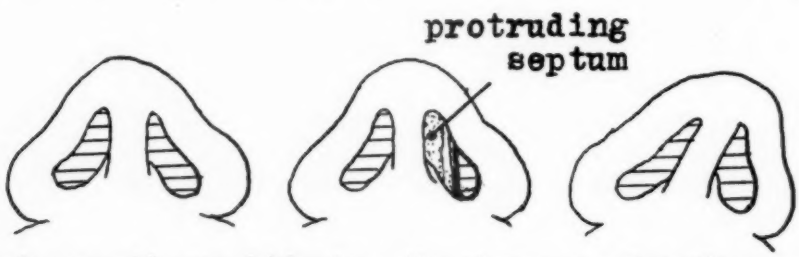

Fig. 16. Deviation of septum with external deformity. A. Normal anatomy. B. Protruding septum. C. Deviation of alar cartilages.

(3) Obstruction of Respiration:

Obstruction of respiration is a frequent concomitant of fracture-depression of the septum since the depressed fragments increase the thickness of the septum. Frequently three or four fragments of bone and cartilage may be shelled out from such

a thickened septum at subsequent operative correction.

b. Deviation of Septum:

Fig. 17a. Fig. 17b.

Fig. 17. Protrusion of septum. Replacement.

Fracture-deviations of the septum may occur with internal deformity, with external deformity, or with both.

(1) Without External Deformity:

Pathology: Fracture-deviation of the septum without external deformity is frequent. The quadrilateral cartilage may be fractured and bent, producing obstructed respiration without any external evidence of the injury (Fig. 13).

Treatment: The immediate treatment of deviations of the septum with or without external deformity is more or less the same. The septum should be anesthetized by the intranasal application of cocaine and then grasped with either a smooth pair of forceps or with the fingers, one in each nostril, and the septum replaced in the mid-position. Intranasal packing maintains the septum until it heals by fibrous union. Where the septum has been dislodged in its entirety from the superior palatal ridge without fracture of the cartilage, its replacement is generally successful and permanent. Where the dislocation has been accompanied by fracture of the cartilage or of its attachment to the perpendicular plate, the replacement may be temporarily satisfactory but the deformity tends to recur. Where the fracture-deviation has occurred without external deformity, poor replacement or the recurrence of the displacement will be attended by obstructed respiration. The patient should be advised that in spite of treatment this obstructive deviation may result and require future excision. When a sufficient length of time demonstrates beyond question that the deviation is not amenable to the treatment aforementioned (the maintenance of an intranasal splint) then the patient should be subjected to a submucous resection which will again provide free nasal passages.

(2) With External Deformity:

(a) Deformity of Cartilaginous Bridge:

Pathology: Fracture-deviation of the septum with deviation externally of the cartilaginous bridge of the nose frequently accompanies fracture-deviation of the bony portion. The quadrilateral cartilage in such instances is frequently deviated in its

entirety, and torn loose from its attachment in the mid-position to the superior palatal ridge (Fig. 14).

Pathology: Fracture-deviation of the septum with its anterior edge presenting at the nares may exist without deviation

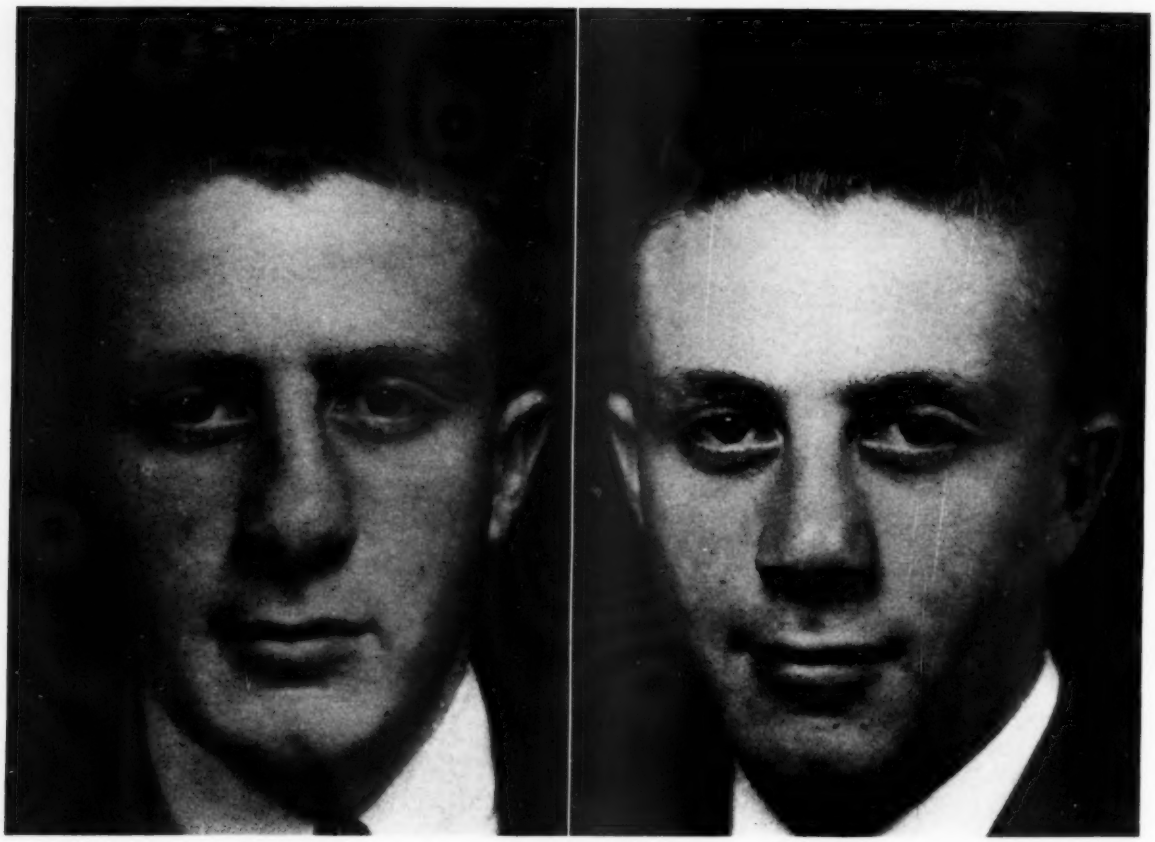

FIG. 18A. FIG. 18B.

FIG. 18. Displacement of alar cartilages by deviation of lower end of septum.

Treatment: When the deviation of the septum causes a twist of the lower end of the nose, attempts should be made to replace the septum (and thereby the nose) in the mid-position. The intranasal manipulation is the same as that for deviation of the nose without external deformity. It is occasionally useful to over-correct the nose to the opposite side and to maintain the lower end of the septum in the over-corrected position by means of either adhesive or a lateral nasal splint. The patient should be advised that here also a perfect result is not always possible. A plastic operation should be advised when a nose obviously remains dislocated despite efforts at manual or instrumental correction (Fig. 15).

(b) Deformity at Tip. (*a*) Protruding Septum:

of the tip or lateral cartilages. This type of deformity is generally due to fracture-deviation of the extreme anterior edge of the quadrilateral cartilage (Fig. 16).

Treatment: Immediate treatment consists in replacing the septum and maintaining it in position as well as possible. Recurrence of the dislocation in spite of treatment will necessitate plastic correction both for cosmetic reasons and to improve nasal respiration. The plastic correction consists in replacing the septum when it is of normal length, and resecting the lower end where it is found advisable to shorten the nose. Attempts have been made to correct this type of deviation by a submucous resection begun at the lower end of the septum leaving no lower support for the nose. This procedure should never be carried out (in spite of its popularity

with leading rhinologists) for the following reasons: (1) it changes the relationship of the columella and the lip and occasionally retracts the columella. This lengthens the lip where a change is esthetically undesirable; (2) by depriving the tip of its support it weakens the dorsum of the nose and permits it to sink under the slightest external trauma.

These protrusions of the septum should be approached by undermining the skin of the nose (as for shortening of the nose), thus giving a free approach to the deflected septum. If the deflection is found to be an integral part of the framework of the nose it should be replaced and the aforementioned consequences of its removal will not occur (Fig. 17). If it is found advisable to shorten the nose the patient should be informed to that effect, and a triangular portion of the septum, with the overlying mucosa, removed. This step will occasionally excise both the complete deflection and the protrusion and also provide, at one and the same time, both a normal respiratory passage and an improved external configuration of the nose. The patient should be treated as though he had had a shortening of his nose for cosmetic reasons only. No intranasal packing is necessary, the columella should be attached to the resected or replaced septum by two braided silk sutures which may be left in place for five days.

(*b*) Deviation of Alar Cartilages:

Pathology: The alar cartilages are frequently displaced along with the deviation of the lower end of the septum (Fig. 18).

Treatment: Correction consists in the replacement of the deviated septum, thus permitting the alar cartilages to return to their normal position.

C. Combined Fractures

Pathology: Fractures of the various parts of the nose in toto show the combined pathology characteristic of the separate deformities.

Treatment: The treatment of fractures of the nose where both the bony framework and the cartilaginous support have been deranged consists in the combination of the various techniques described to suit the individual case.

II. COMPOUND FRACTURES

Pathology: Lacerations of the skin, with retraction of the skin borders producing defects of various shapes and sizes, may accompany fractures of the nose. Where the destruction of tissue is of extreme degree, ulceration of the skin of the nasal bridge may result which in itself may lead to infection of the fractured bones, necrosis and loss of periosteum, bone and lining mucous membrane. The result is a perforation.

Treatment: The cleansing of skin lacerations and the debridement of destroyed tissues is of great importance in the treatment of compound fractures of the nose. Lacerations of the skin should be sutured or held in apposition by strips of adhesive. A dirt or oil tattoo of the nasal skin may occur, which can be excised on a subsequent occasion. Skin infection may spread to the periosteum and bone with necrosis resulting in a perforation into the nasal cavity. This deformity requires careful plastic correction and may necessitate a series of operations which should not be undertaken until complete cicatrization has taken place.

CONCLUSIONS

1. The nose is composed of six individual structures and a simple diagnosis of fracture of the nose is of no value without a detailed analysis of the structures involved in the injury.

2. Any combination of the six structures may be involved in the fracture which accounts for the large variety of deformities following such an injury.

3. Deformities of the nose resulting from fracture are often disguised by an edema of the soft tissues.

4. Not all acute fractures can be successfully treated by immediate manipulation.

5. The necessity for a possible subsequent submucous resection and plastic operation should be impressed upon the patient.

SURGICAL PROSTHETICS OF ORAL AND FACIAL DEFECTS*

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IN defining surgical prosthetics there are two viewpoints, but concisely, the term is used to designate the mechanical restoration of lost tissues. Surgical prosthetics of the intra-oral cavity and the extra-oral structures is that branch of dentistry which aims to reconstruct congenital and acquired defects by appliances intimately associated with surgical treatment. The purpose is twofold, viz., the restoration of function as far as possible, and cosmetic improvement.

Surgical prosthesis is the mechanical restoration of intra- and extra-oral defects.

HISTORICAL REVIEW

The technique of surgical prosthesis was practised in the fifteenth century, accurate records attesting the fact that skilled practitioners artificially restored organs and essential parts of the body, such as the orbit, nose, lip, cheek, etc.

Modern progress in this art owes much to the early pioneers in surgical prosthesis, whose experiments and innovations set a standard which guided and inspired the work of succeeding generations of technicians.

The appliances used by practitioners such as Petronius, Paré and Lusitanus, were concerned only with the stopping up of existing clefts. From this operation we derive the term "obturator," from the Latin *obturare*, meaning literally "*to stop up*," and was commonly applied in those early days.

Today, by basically similar but improved appliances, we are attempting to restore defects of congenital or acquired origin to normal form and function.

It is not inconceivable that the principle of the obturator was known to the early physicians. It would be natural for a person with a perforation of the palate, to conceive an idea that would bring him relief; and it is most probable that this was obtained by using a small sponge, a wad of lint or a strip of thin leather, either thrust into the cleft or covered it temporarily.

The following excerpts from ancient case records show that the pioneers of the fifteenth and sixteenth centuries experimented with the art of surgical prosthesis.

Hollerius, in his "Observ. ad Calcem de Morbis Internis," 1552 suggested that wax or a sponge be used to stop up apertures in the hard palate. He was the first to leave a written report of an attempt to close a cleft.

Alexander Petronius, in his "De Margo Gallico," 1565 described methods for the closure of clefts. He recorded the first definite suggestion for a workable mechanism to act as a palatine obturator. Petronius said, "If the decayed bone of the palate falls off itself, or if we extract it, the pronunciation is altered so much, that the patient can scarcely be understood. In certain cases, it is possible to repair this loss; for example, when there is only a hole in the palate, we can stop it up with cotton, with wax, a gold plate, or in any other method that the technique of the artist suggests, making certain that these instruments reproduce the same concave form as the palatine vault." This is the first time that the use of a gold plate is mentioned, but apparently the credit for using this material is not attributed to Petronius.

Description by Ambrose Paré in 1579 is as follows:

"Many times it happeneth that a portion or part of the bone of the palate, being broken by the shot of a gun, or corroded by the virulency of the Lues Venerea, falls away, which makes it impossible for the patients to pronounce their words distinctly, but rather obscurely and snuffling in sound. Therefore, I have thought it

* Read before Am. College of Dentists, Atlantic City, Dec., 1932

a thing worthy of labor to demonstrate how it may be helped by the art.

"The cavity of the palate must be filled with a plate of silver or gold a little bit bigger than the hole itself; but it should be as large as a French crown, and made similar to a dish in figure; on the upper side near the brain, a small sponge must be fastened, which, when it is moistened with the moisture distilling from the brain, will swell up enough to fill the concavity of the palate. Consequently, the artificial plate cannot fall down, but stands fast and firm as if it stood of itself."

Paré also described another form of obturator, resembling to a great extent the modern cuff button. The appliance consisted of two buttons or discs of different sizes, the larger fitted to the roof of the mouth and covered the opening, was connected by a revolving stud or screw to an oblong plaque representing the extreme length of the perforation. The appliance was put in place and the screw turned, thus locking it directly over the cleft.

Pierre Fauchard first published his famous "Le Chirurgien Dentiste" 1728, in which he described and illustrated more complicated mechanisms for these defects than had previously been used. He depended upon the device passing through the aperture and resting on the superior surface of the surrounding border. Fauchard was apparently the first to construct such appliances for mouths in which artificial teeth also had to be supplied. His object was to have a convex-concave plate cover the fissure through which passed two wings folded together. When the plate was in the proper position, the wings were turned out by means of a screw arrangement. Small pieces of sponge were attached to these wings to adapt the appliance to the tissues.

M. de la Barre, in 1820 was the first to describe the use of an elastic gum in the restoration of the velum and uvulae. The appliances which la Barre constructed were quite ingenious, but so complicated and requiring so much skill to make, that the profession at large did not accept them. His mention and use of the so-called "elastic gum" are noteworthy.

Mr. Snell was probably the first to conceive the idea of making a model of the affected mouth, on which he would construct and mount his obturator. Up to this time, 1828, there is no record showing the use of a model. In his book Mr. Snell stated: "My method of constructing an obturator is with a gold plate, accurately fitted to the roof of the mouth, extending backward to the os palati, or the extremity of the hard palate, about an inch in length, being carried through the fissure."

This obturator was similar in construction to our so-called retaining plate. To that part of the plate which corresponds to the nasal fossae, two vertical plates are soldered, meeting in the center and carried upward through the fissure to the top of the remaining portion of the vomer, to which the appliance should be exactly adapted, the surfaces conforming to the natural shape of the nasal palatine floor. Thus the nasal secretions will be carried directly backwards into the fauces. A piece of prepared elastic gum is then attached to the posterior part of the plate where the natural soft palate begins, extending downward on both sides as low as the remaining part of the uvula, and grooved at its lateral edges to receive the fissured portions of the velum.

As is evident from these early records the principal oral defect is the congenital cleft palate. Other deformities of less frequence are acquired, and are invariably associated with destruction of tissue and distortion of the remaining parts, which may involve the loss of a section of the maxilla, mandible, nose, orbit, ear or cheek.

Classification

ORAL AND FACIAL DEFECTS SUITABLE FOR PROSTHETIC TREATMENT FORM TWO MAIN GROUPS

1. Intra-oral Defects:
   (a) Maxillary: (1) dental; (2) alveolar.
   (b) Mandibular: (1) dental (2) alveolar.
   (c) Palatal: (1) congenital (2) acquired.
2. Extra-oral Defects: (a) Orbital (b) Aural (c) Nasal (d) Cranial.

INTRA-ORAL DEFECTS

Dental Defects. By far, the most common oral defect is dental, involving the loss of teeth due to caries, trauma by malocclusion, or a direct blow dislodging the teeth.

Edentulous means the loss of all the teeth of both the upper and lower jaws. The average individual rarely reaches maturity without losing one or more teeth. In areas of missing teeth, considerable resorption takes place in the alveolar process, thus causing labial and buccal depression with more or less marked cosmetic disfiguration as well as loss of facial symmetry.

To the prosthodontist falls the task of replacing the missing organs and restoring the function, the form of the oral cavity and the facial expression.

Various causes for the continuous resorption of the alveolar process following the extraction of teeth may be due to local pathology, general low resistance, and ill-fitting partial or full dentures, especially when too hastily inserted. The latter will cause a kneading action on the alveolar ridge, this irritation hastening resorption and causing a hypertrophy of the gums. Resorption of the alveolar ridges in the upper and lower jaws may continue throughout life and cannot be controlled and may progress until the ridges eventually vanishes. In such a case alveolectomy may be necessary for esthetic reasons.

MAXILLARY AND MANDIBULAR DEFECTS: DENTURES

These may be classified as (a) immediate—temporary; (b) permanent.

A. The *immediate-temporary dentures* are those that are constructed and ready for insertion before the extractions have been completed. An impression is taken of the mouth with the teeth in place, a cast is made, cutting each tooth off the model and replacing it with an artificial tooth until the full complement of teeth is replaced. Upon the second sitting the teeth are extracted and the denture inserted in the mouth, utilizing the alveolar sockets for the artificial teeth.

The immediate-temporary denture has its advantage by acting as a splint to the injured tissues, preventing swelling, controlling hemorrhage, compressing the bony tissues, permitting healing to take place more readily, and helping to form a compact rounded ridge for a permanent denture.

B. *Permanent dentures* are constructed for the patient after the alveolar sockets and ridges have completely healed. This generally takes place in six to twelve months, depending upon the health of the individual.

The procedure is as follows: impression, bite, setting up the teeth on an anatomical articulator to determine occlusion, articulation, esthetics and expression.

ESTHETICS

No matter how skillfully adapted for speech and mastication an artificial denture may be, such artificiality must be apparent to the possessor unless the age, temperament, facial contour and the natural expression are taken into account.

In extreme old age, the atrophied condition of the jaws, due to the gradual loss of all the teeth and the resorption of the alveolar processes, produces that decided alteration in the features of the aged with which we are all so familiar. The change which invariably takes place in the angle of the lower jaw in consequence of the disappearance of the teeth and processes, causes the chin to project, and when the jaws are closed, the nose and chin approximate each other. Even when they are apart, the falling in of the lips so encroaches upon the oral cavity as to make it too small for the tongue, and thus renders the speech feeble and indistinct. It is that in such instances the prosthodontist exhibits his skill and artistry, not only by replacing the lost expression of the face, but also by restoring the medium through which the wants and thoughts of the individual are made known to others.

PALATAL DEFECTS

There are two types of palatal defects namely congenital and acquired.

1. Congenital defects are due to lack of union of the palatal processes of

the maxillary bones and the lateral processes of the nasal bones. This defect is revealed between the eighth and tenth weeks of intrauterine life.

2. Acquired defects arise from
   (a) Trauma: such as gunshot wounds, injuries sustained in auto accidents, athletic games, etc.
   (b) Disease: such as sarcoma, carcinoma, necrosis, osteomyelitis, tuberculosis, syphilis, etc.
   (c) Radium and *x*-ray burns.

CONGENITAL DEFECTS

The congenital cleft palate is the result of arrested development in embryo of the parts involved, and the failure of these parts to unite during their developmental period in fetal life. The fissure may extend to any degree varying from a slight notch of the lip or the uvula, to a complete cleft of the lip, the alveolar process, the palatal bones and the velum palati.

The formation of the maxillary process begins about the twenty-eighth day of fetal life. At the end of the tenth week, the palatal processes have united. Union begins at the anterior aspect and progresses backward, the uvula being the last to unite. Consequently, the size and extent of the fissure depends largely upon the time of the interference in the process of development.

The cause of the condition is uncertain and may be due to one or more factors; faulty nutrition, maternal impressions, syphilis, alcoholism, crowded position of the fetus, etc.

Some have thought the defect to be caused by the lack of sufficient calcium phosphate in the system of the mother during gestation. This theory has very little weight, as it is a fairly well-established fact that union or coalescence of the tissue does not depend upon ossification, but takes place in advance of ossification. It is also known that a sufficient supply of calcium salts must be supplied to the mother to offset the demands of the growing fetus.

The question of hereditary influences would seem to play an important part in the production of this defect, some family histories presenting these hereditary influences, but most do not. Dr. Charles B. Davenport, of the Carnegie Institute Department of Experimental Evolution, who has made extensive investigation along this line, writes: "While we have been able to accumulate a large number of pedigrees, we have not been able to get the exact key to the method of inheritance of the cleft palate. We know merely in general that it is inherited, or that heredity plays an important part in its production."

Acquired defects are numerous, irregular in character, varying from a slight perforation in the hard or soft palate to the complete absence of the soft tissues and bony framework.

There are several methods for the retention of restorations for this type of defect:

1. Adhesion, as in edentulous cases
2. Utilization of existing teeth as abutments
3. Bulbous extensions into existing perforations
4. In rare cases the use of spiral springs.

In some cases it is necessary to employ a combination of the methods.

Surgical and Prosthetic Correction. In properly selected cases, surgical restoration of the cleft palate is the desired method by a skilful oral or plastic surgeon. However, there are several definite contraindications to surgical treatment, namely: (1) age of the patient, (2) inability of grafts to take, (3) extensive defect, or (a) secondary defect caused by excessive postoperative tension, or (b) insufficient amount of tissue left for surgical repair without shortening the uvula, in which case speech will not be improved. In order to realize the significance of the contraindications for surgical intervention, and to devise and fit suitable prosthesis, it is important that one should be familiar with the normal structures of the tissues and their functions, as well as the abnormal. This presupposes a thorough knowledge of the anatomy and

physiology of the parts involved, as well as their embryology and histology.

The larynx and the oral and nasal structures, with the cavities as resonators, constitute the speech mechanism. The structures of these organs and their relationship demonstrated in Figures 1, 2, and 3.

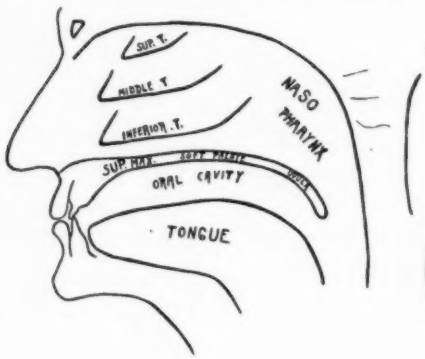

Fig. 1.

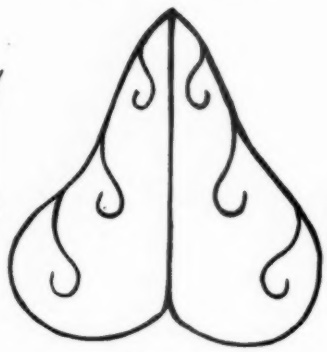

Fig. 2.

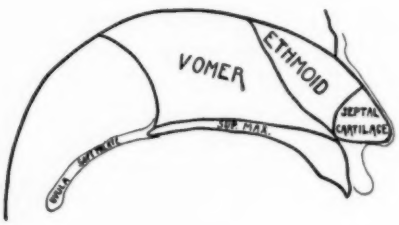

Fig. 3.

Figs. 1–3. Schematic drawing demonstrating relationship of organs of larynx, oral nasal cavities and the six resonance cavities.

The palate, one of the most important parts of this voice mechanism, regulates the size and shape of the oral resonating cavity, forming the tone of the voice and closing the nasal passages in the emission of certain sounds. It is principally because of defective speech that patients with cleft palate seek treatment.

In surgery or prosthesis the object is to restore the deficient parts in a manner that will enable the muscles to perform all the functions necessary for normal speech. If this restoration is possible, the patient, with proper training, should be able to speak with perfect articulation and normal tone quality.

The perfect objective would be to surgically restore all the missing tissues so that normal speech would result. Unfortunately, this goal cannot always be attained.

Fully recognizing the necessity for a complete closure of the palate in order to satisfy the yearning for normal speech, many surgeons of this modern age, such as Brown, Blair, Davis, Dorrance, Ivy, Vaughan, Kazanjian and Dunning, have done plastic operations, skillfully lengthening the velum in order to enable it to function properly as an aid to speech.

However palatal surgery is not always successful. Operative procedures causes destruction of muscular tissue which is essential to this indispensable organ of speech. The resultant cicatricial rigidity of the palate mitigates against further effort for the possible restoration of normal speech function.

At this point the closest cooperation should exist between the plastic surgeon and the dentist. The method of procedure, surgery or prosthesis, should be decided jointly wherever possible.

Indications for Prosthetic Restoration. Prosthetic appliances should be employed:

(1) When quick painless results are desired by the patient
(2) When the deficiency is due to a disease that makes surgery a doubtful procedure
(3) When the defect is too extensive
(4) When the physical condition of the patient contraindicates the strain of a long series of plastic operations
(5) When a temporary appliance is desired preceding a series of plastic operations.

MECHANICAL TREATMENT

Heretofore, apparently the only object in constructing restorations for these cases has been to close off the nasal passages from the oral cavity. No account was taken of the important part the vomer has in breaking up the current of air during inspiration, nor of the part the nasal

cavity has in the production of resonance in voice and speech. In the appliances that we are now constructing, all these important factors are considered, and we attempt to reproduce all lost or missing tissues in as normal a state as possible.

Technique in General. Using dentocoll as the medium, we take a full impression of the complete cleft, to obtain study models with all the soft tissues in their proper relationship. A second impression is taken to reproduce a working model for the construction of an obturator retaining denture, which serves two-fold, to close over the maxillary defect and to support the vomer and velum attachment.

In cases in which the teeth are a factor in construction, impressions of the mouth are obtained in modelling compound.

The casts are then poured into Weinstein's stone, and models of the exposed teeth are made by fashioning a single layer of softened red wax over the teeth and then trimming off the excess wax down to the gingiva.

For the retaining dentures, it is possible to use gold, silver, platinum alloys or vulcanite rubber, but because of its maximum strength with a minimum thickness, vitallium is preferable.

For the construction of splints, impressions of the mouth are commonly made in modelling compound. A model of the splint is then made by burnishing a single layer of red wax over the teeth on the casts as far as the gingiva.

This method of obtaining impressions for splints has many advantages over the use of plaster, the most outstanding being that in removing the compound impression the undercuts 'draw,' consequently in the finished state there is little difficulty in applying the splints due to the fact that undercuts are not lacking.

A hinged type movable velum is preferable in those cases where there is considerable flexibility to the uvula and the palato-pharygeal musculature, as well as in instances in which no attempt has been made to surgically close the posterior cleft. A fixed, immovable velum is preferable in the cases in which there is fixation from cicatricial tissue, as in an acquired, syphilitic cleft.

The velum is often reproduced in luxene, a synthetic resin, its color resembling the palate tissues and very compatible with them. It has sufficient weight to keep it in position when the palatal muscles are relaxed, and yet is not too heavy for the muscles to raise in contraction. This movement is made possible by the hinge attachment. This type of restoration is most hygienic. Moreover, the vomer attachment is constructed of a metal which assumes body temperature and aids in the warming and moistening the inspired air.

While restoration is a primary factor in replacing normal function, education is necessary to improve speech, owing to the fact that the patient could not enunciate properly because of the lack of tissues in his attempts to produce the various speaking sounds he brings to his aid other tissues or parts. Thus, it becomes difficult to overcome habits.

The completed restoration put into place in the mouth, functions as an anatomical part. The patient becomes a pupil in phonology and orthoëpy, and is instructed in perfect articulation, as well as normal voice tone and resonance. Tongue gymnastics are of great importance in bringing new life to the suppressed activities of this organ by voluntary movements in direction, position and rapidity.

CASE REPORTS

To demonstrate the construction of suitable appliances typical cases are described:

Case 1. L., aged 16 years, one of five children, was the only member of the immediate family who had a deformity. There was no history or indications of cleft palate in either the maternal or paternal ancestors. The girl was robust and in excellent health.

Oral defect: At birth there was a complete bilateral cleft with bilateral hare lip. The hare lip had been repaired at an early age, and an unsuccessfull attempt made to close the maxil-

lary cleft. The vomer bone was partially missing.

Mechanical Treatment: A suitable De Trey dentocoll impression tray was selected and a perforated fusible metal section to approximate the posterior pharyngeal wall soft soldered to the posterior end. A vitallium retaining denture was then constructed over this working model.

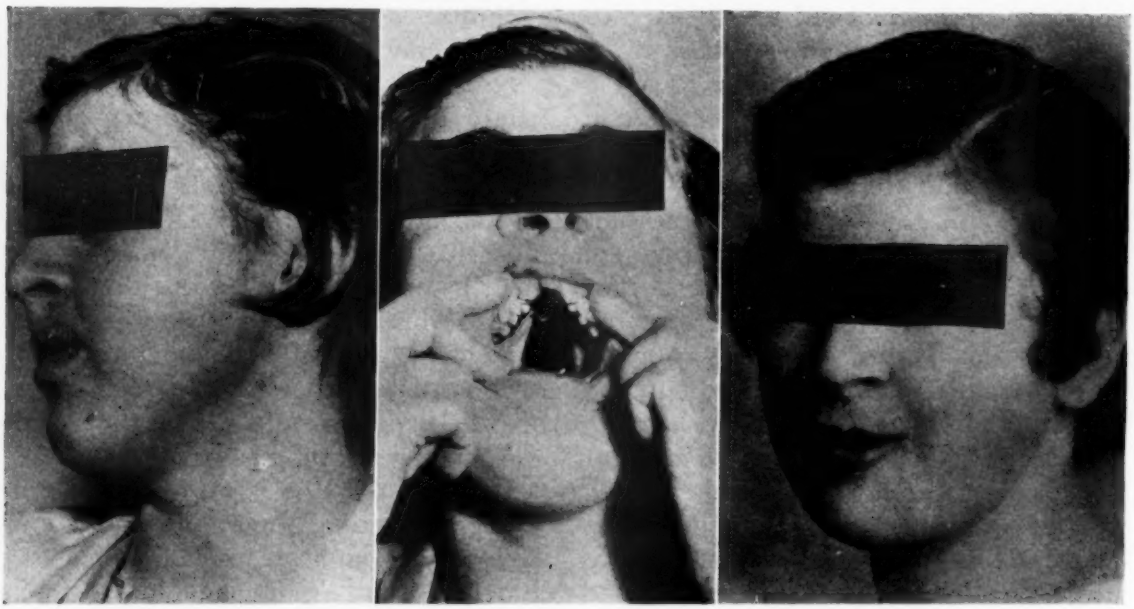

FIG. 4A. FIG. 4B. FIG. 4C.

FIGS. 4A and 4B. Complete cleft of hard and soft palates. C. Double harelip, subsequently corrected by Dr. Robert Ivy.

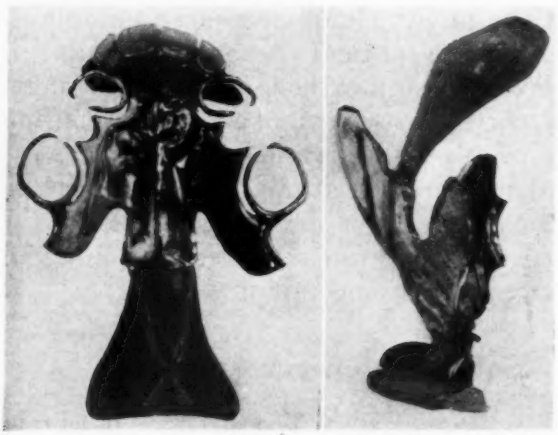

FIG. 5. Completed appliance, nasal and palatial. Note hinge attachment and vomer restoration.

By using base plate wax attached to the nasal aspect of the metal denture, we reproduced the missing portion of the vomer bone upward to approximate the tissues and as far back as the posterior border of the hard palate. This was fitted and tried in the mouth to be sure of its close adaptation to the tissues.

It was necessary to employ a hinged velum attachment. In order to close the cleft in the soft palate with some device that would stay in position during the muscular movements of the tissue, a piece of base plate gutta percha was shaped to fit the cleft snugly from side to side, thus forming the roof of the mouth and floor of the nasal passages, widening out as it extended backward, to form a flange on both sides overlapping the upper edges of the palatal tissues. The movable section of the hinge was imbeded in its anterior portion and the whole attached to the retaining denture. This was then placed in position in the mouth and the proper approximation was obtained by careful trimming or adding with low fusing Everett's wax. The appliance had to extend sufficiently posteriorly and be so shaped that when raised by the musculature, as in the act of swallowing, it touched the posterior wall of the pharynx in order to entirely close off the passage into the nasal cavity. This velum was then reproduced in luxene.

In addition to this restoration, education to improve speech was necessary. It was necessary to practice the phonetic sounds of the vowels followed by all the explosives: the object being to strengthen and develop the pharyngeal and palatal musculature so that they would firmly and involuntarily close around the artificial velum, completely preventing the vocalized air escaping into the nose. See Figs. 4A, 4B, 4C, 5.

Case II. Mr. E., aged forty-two.

History. A pimple at the junction of the hard and soft palate on the left side, was opened and subsequently became infected. The tissue surrounding this area hypertrophied and eventually sloughed, leaving a perforation about the size of a pea. As biopsy revealed carcinoma, this area was treated with radium and *x*-ray. Following this intensive irradiation several unsuccessful surgical attempts were made to close the perforation.

Fig. 6A. Fig. 6B.

Fig. 6A. Perforation at junction of hard and soft palate.
Fig. 6B. Restoration in mouth.

Description of Oral Defect. When first seen it was found that the mucous membrane of the whole palate was intensely inflamed, and an irregular almond sized perforation in the soft palate at the maxillary junction. It was apparent that the irritation had been produced by a red rubber vulcanite appliance which he had worn to close over this aperture. This appliance was constructed of a material contra-indicated in these cases, was also ill-fitting and covered entirely both the hard and soft palates. (Fig. 6A.)

Mechanical Treatment. Vitallium was selected as the medium because of its compatibility with these tissues. A palatal bar was constructed the available teeth being utilized for its retention by clasps. To the posterior aspect of this palatal bar, an oval flange extension about 8 by 12 mm. was spot welded to seal over the perforation. As is always true in this type of acquired case, normal speech was immediately possible upon the insertion of the restoration. (Fig. 6B.)

It is noteworthy that after several weeks, the tissues of the palate assumed a healthy appearance, and the irritation surrounding the defect cleared up entirely.

Fig. 7. Acquired cleft in palate. Nose had been restored by pedicle flap from forehead.

Case III. Miss S., aged fifty.

History. There was a large cleft of the soft palate, which had its anterior margin at the

juncture of the hard and soft palate and extended back as far as the uvula, being about 23 mm. in width. There was very little movement of the remaining musculature due to the presence of scar tissue. (Fig. 7.)

Etiology. A large gumma involving the whole of the nose and half of the soft palate, with breaking-down of tissue, was responsible for the condition.

Treatment. The specific treatment, in this case, consisted in the construction of a retaining plate with an attached vulcanite obturator. The obturator, in this case, was not to replace all the tissues lost, but was to close the nasopharynx and thus reestablish articulate speech. The nose was surgically constructed by means of a pedicled flap from the forehead and then made rigid by the implantation of costal cartilage.

An impression was taken with the correctible plaster technique, the imprint first having been taken in soft modeling compound, then trimmed to the desirable muscle where necessary, and then given a plaster wash to correct any defects in the initial impression. This was then "boxed in" and poured in stone.

The retaining plate was constructed by the regular partial denture technique with the exception that an undercut section was removed from the palatal aspect of the plate. This section was about 12 mm. wide and about 25 mm. long, running antero-posteriorly. The purpose of removing this undercut section was to form a means of attaching the obturator portion. When the retaining plate was completed (fitted, polished, etc.) a wire loop was set in place in this undercut section and the plate inserted in the mouth to see that the wire did not compress the tissues. The denture, with wire attached, was then removed and on this loop was fashioned a ball of softened carding wax, the approximate size and shape of the whole cleft. This was waxed fast to the denture and the whole then placed in position. The patient was requested to close the mouth, compress the cheeks and then swallow several times. The act of swallowing would naturally bring about a contraction of the musculature of the soft palate to close off the nasopharynx. In this case, due to the scar tissues there was not much movement of the remnant of the palatal muscle but what little movement had taken place was recorded on the soft wax. This ball of wax was then chilled with cold water and the whole removed.

A slight imprint of the muscles was seen on each side of the ball. The excess wax was trimmed down to the extent of the imprint on the palatal aspect. The periphery of the wax was now softened and again placed in the mouth, the patient swallowing. There was some tendency to gagging due to the approximation of the wax with the dorsum of the tongue. In order to overcome this, the wax bulb had to be trimmed off short of the dorsal extremity of the soft palate and in order to effect a suitable closure of the cleft, the bulb was extended to reach the posterior wall of the nasopharynx, this being once more inserted and the patient swallowing again.

It was now thought that the cleft was sufficiently closed to permit correct articulation of words. The most difficult words to enunciate in such a condition are the so-called hissing consonant words such as scissors, siss, etc. These were pronounced with apparent ease so it was evident that the obturator would function properly when completed.

At this point we would like to report two cases that demonstrate prosthesis as an adjunct to surgery. The first case comprises the construction of an intermaxillary retraction splint to retrude a prognathous mandible upon sectioning. The second case illustrates the construction of an intermaxillary splint of the Gilmer type to immobilize the mandible for the placing of a bone graft following resection of a portion of the mandible for osteomyelitis.

Case IV. Mr. A. C., aged twenty-three years.

Existing Condition: There was pronounced protrusion of the mandible, necessitating bilateral sectioning of the mandible and subsequent removal of an inch of bone. The prognathous condition was probably due to acromegaly.

Mechanical Treatment: The specific treatment was the construction of a set of metallic splints that would retract the jaws after the excision of a segment of bone.

Impressions of the mouth were obtained in modeling compound. The casts were then poured in Weinstein's stone and models of the exposed teeth were made in wax, by fashioning a single layer of softened red wax over the

teeth and then trimming off the excess as far down as the gingiva. This was constructed in a continuous strip, shaped to take the form of the desired splint.

It was necessary now to provide some attachment to produce a retraction of the mandible. The method employed was to cut an Angle's orthodontic band in half and form a loop on the cut ends; this provided a means of attaching the sections to the finished splint. A wire loop was also placed on each splint (now in the wax) between the central incisors for subsequent wiring together of the maxilla and mandible. These splints were cast in Weston's metal according to the usual technique. The splints were fastened in place before the operation with a slow-setting crown and bridge cement.

The operation, in general, consisted of severing the mandible in the region of the angle, drawing it forward to slip the retracting bands in place, and these were tightened by a locknut attachment until the jaws were in their proper relation. A wire was then slipped through the anterior loops which were fastened together.

Case v. Miss R. I., aged twelve years.

Existing Condition: This was a case of osteomyelitis which had involved surgical removal of a section of the right mandible in the region of the angle. The lower jaw presented a marked underslung condition on the left side due to the removal of a section of bone on the right side and the subsequent drawing over of the fragments to approximate each other. The jaw was pulled laterally and posteriorly.

Mechanical Treatment: The treatment in this case, was the construction of a set of metal splints to hold the jaws in correct position after the operation for the correction of the deformity. The mandible was divided in the region of the ramus and the adhesions freed. The splints were to have a single locking device which was to be placed on the side opposite the site of operation.

Impressions of the mouth were obtained in modeling compound. This method of obtaining impressions for splints has the advantage over the use of plaster in that there are no undercuts.

A wax model of the splints was made by burnishing a single layer of red base plate wax over the teeth on the casts as far down as the gingiva.

A locking device was constructed and set in place in the wax. The models were then removed from the casts and their distal ends joined. Following the models with this the sprues attached at the joint were invested in casting investment, and after subsequent "burning out" were cast in Weston's metal.

Upon completion, the splints were tried in place and then cemented fast, by the use of a slow-setting crown and bridge cement.

EXTRA-ORAL DEFECTS

Orbital Defects. In malignancy of the orbit with extensive involvement necessitating complete removal of the orbital contents and adjacent tissues, surgical prosthesis plays a most important role in accomplishing a cosmetic result. These restorations also protect the operative areas and permit easy, frequent inspections for possible recurrence.

The following case demonstrates an involvement of the orbit and cheek as the result of an extensive carcinoma of the upper jaw.

Case vi. *History.* Miss E. S., houseworker, aged fifty-eight years, Irish.

She was first seen on July 14, 1923, presenting a painless swelling of the left side of the cheek and some bulging over the alveolar process in the left upper molar region. All the teeth had been removed fourteen years previously.

Family History: The family history was essentially negative.

Past History: Seventeen years ago she had kidney trouble; she also had bronchopneumonia and has suffered from bronchitis more or less ever since. There had been no operations or any serious injuries.

Present Illness: In February, 1923, the patient noticed some pain in the gums of the left upper jaw and left occipital headache, radiating to the top of the head. With her finger she felt a thickening in the upper jaw in the region of the last molar. About the same time she noticed a swelling of the left cheek.

July 16, *x*-ray examination of the maxillary sinuses by Dr. Pancoast showed clouding of the left side. July 27, Dr. Ivy made a small incision in the left upper jaw entering the antrum, and the specimen taken for biopsy was reported (Polyclinic Hospital) as papillary squamous carcinoma.

July 28, she was referred to Dr. Pancoast at the University Hospital for radiation treatment. Examination at this time showed a wound in the upper left jaw at the premolar region at the site of the antral exploration. A sense of fullness and thickening over the left cheek; apparently no nasal obstruction; no glandular involvement on either side of the neck; very little pain; no disturbance of vision.

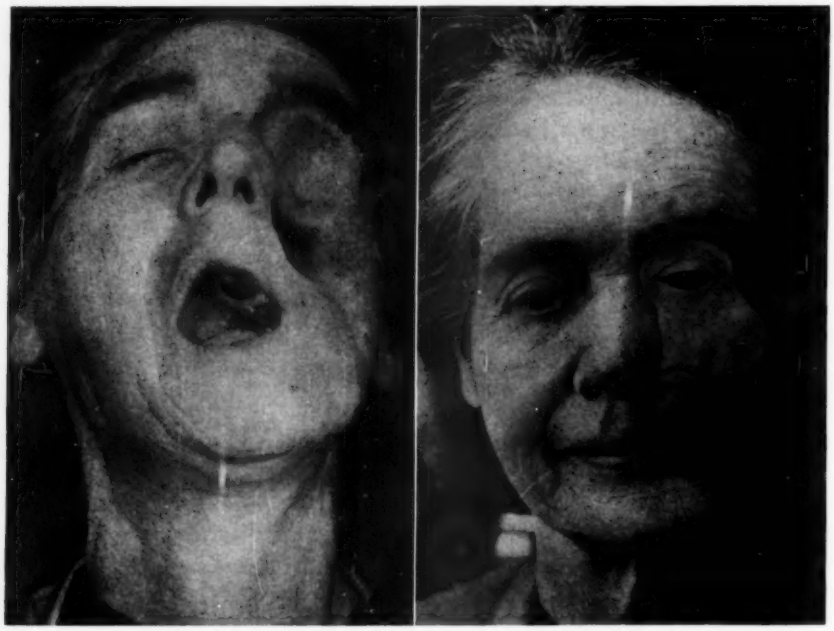

FIG. 8A. FIG. 8B.

FIG. 8A. Carcinoma of palate, antrum and orbit.
FIG. 8B. Complete facial and orbital restoration.

Treatment. July 28, July 30, and August 3, radium was applied to the left antrum and upper jaw. *X*-ray treatment was given to both sides of face and neck on July 28, October 5, and December 10, 1923. March 1 and November 10, 1924, and December 29, 1925 (full doses).

August 7, 1923, under endopharyngeal ether, the Crosby-Green operation was performed by Dr. Muller, exposing the interior of the left antrum for the insertion of radium. August 21, radium was inserted into the antrum.

On March 22, 1924, the left eye was enucleated and superior maxilla was resected by Dr. Muller.

Subsequent pathological examinations were negative for carcinoma.

March 1, 1925, the patient was referred to the Evans Institute for prosthesis. There was a large opening through the left cheek into the mouth and nose, also the left side of the hard palate was missing due to the removal of the left maxilla. This interfered greatly with articulate speech. The patient was unable to move the mandible more than 0.5 mm. on account of adhesions, thus preventing the taking of impressions for prosthesis. The left eye was absent and the socket contracted.

March 27, 1925, at Polyclinic Hospital, under colonic ether anesthesia, Dr. Ivy sectioned through the left ascending ramus of the mandible to permit opening of her jaw. Impressions for prosthesis then could be easily taken.

October 23, at Polyclinic Hospital, under ether anesthesia, the left eye socket was obliterated by dissecting out the conjunctival sac and suturing the lid margins (Dr. Ivy).

Prosthetic Treatment. The method of treatment consisted of replacing the tissues lost through surgical operation with a prosthetic appliance. This appliance consisted of a full upper denture in the form of an obturator to remedy the loss of the palatal tissue; a full lower denture, an artificial cheek to restore the contour of the face as accurately as possible, the placement of an artificial eye of suitable form and color, and upper lid and lower lids. (See Figs. 8A, 8B.)

AURAL DEFECTS. Defects of the auricle may be congenital, traumatic or due to malignancy. Our experience has been limited to the two latter types, prosthesis

being particularly well adapted for these cases. In the following cases the Hanau method of electro-deposition was used.

Fig. 9A. Fig. 9B.

Fig. 9A. Loss of right ear with lower lobe remaining.
Fig. 9B. Restoration in position.

Case VII. Mr. T., aged thirty-seven years.

History. Several years previously the patient had been in a railroad accident and among other injuries suffered the loss of all but the lobe of the right ear. (See Fig. 9A.)

Mechanical Treatment consisted of the construction of a restoration of the missing aural portion to fit over the remaining stump of the ear. The appliance selected for this case was to be made with a gold base where contact is made with tissues, and the body to be electroformed in silver.

The first step was to obtain accurate models of both the mutilated and intact ears, and negocoll was used as the impression medium. A model of the intact ear was desired in order to accurately reproduce its opposite.

A piece of 33 gauge gold was burnished over the portion of the model of the mutilated ear which represented the stump. This was more accurately adapted by swaging. Over this, a reproduction of the reverse of the intact ear was carved in Kerr's blue inlay wax, using the model of the left ear as a guide for the contour. This was removed in toto from the cast and prepared for electro-deposition.

The wax pattern was now prepared for electroforming, first varnishing the gold base on the tissue aspect to prevent deposition of silver thereon. Silver was deposited to an approximate thickness of 40 gauge (the deposition can be controlled by the elements of time and current utilized), by the electroforming electroplating technique as developed by the Hanau Engineering Corporation.

The restoration was tinted with flesh color lacquer as a basic tint. With the appliance in position, the final tinting was done to harmonize with the complexion.

The prosthesis was retained by means of the following adhesive medium suggested by Dr. Herman Prinz of the University of Pennsylvania.

Para rubber.....	2 parts
Gum mastic.....	32 parts
Chloroform.....	100 parts

The main advantage of the method employed in the construction of this appliance lies in the possibility to reproduce the irregular folds of the ear. To swage such a restoration as has herein been described is impossible.

With controlled current, it is possible by the use of the Hanau method, to reproduce the details in the completed appliance as originally carved in the wax. There will be a slight stippled effect which adds naturalness and aids in the retention of the coloring material. (See Fig. 9B.)

Case VIII. Mr. B., aged sixty-eight.

History. Following carcinoma of the right auricle necessitating amputation, only a small section of the upper and lower lobes remained. tient had been treated with radium and *x*-ray therapy for carcinoma of the right lateral section and portion of the septum of the nose.

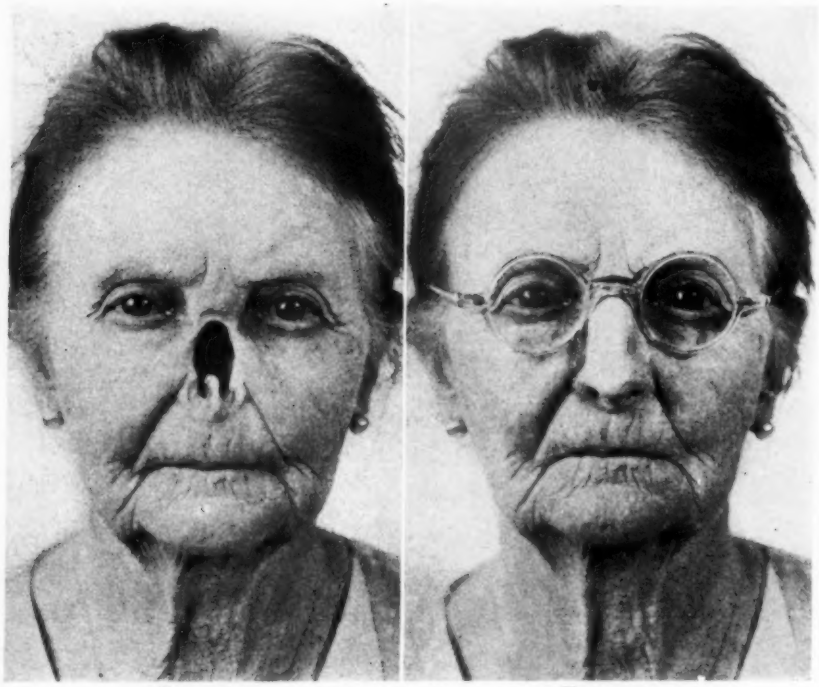

Fig. 10A. Fig. 10B.

Fig. 10A. Carcinoma of complete nose amputation.
Fig. 10B. Nasal restoration, front views of the nasal prosthesis.

Treatment in this case was essentially the same as that described in Case VII with the exception that in this case the entire restoration was made by electro-deposition on a wax model, the portion approximating the tissues being subsequently gold plated.

The remaining stumps aided greatly in the retention of the appliance.

It is pertinent to mention here that where the entire ear is absent, we are sometimes able to utilize the aural canal in conjunction with spectacle frames to hold the prosthesis in position. It is also possible in some instances to obtain sufficient retention by extending flanges into artificial pockets formed by means of plastic surgery.

NASAL DEFECTS

Nasal defects may be classified as partial or complete, depending upon the extent of the loss of tissues.

Case IX. Mr. W., aged seventy-three years.

History. Several years previously the patient He was referred from the Newark City Hospital by Dr. Lyndon Peer, who had removed a section of the nose by the electrosurgical knife, excising the entire diseased tissue leaving good margins of healthy tissue.

Prosthetic Treatment. A cast was made of the face using negocoll as the impression medium. The nose was molded to a normal contour with plasticene. In this case a gelatin mixture was the medium selected for the restoration. Thus it was necessary to construct a die and counterdie, in order to reproduce the section molded of plasticene.

The formula for the gelatin was suggested by Dr. Batson of the Graduate School of Medicine, University of Pennsylvania. It consists essentially of equal parts of gelatin and glycerine with enough distilled water to bring the gelatin into solution, to which water soluble dyes are added until the proper tint is obtained.

This gelatin nose lasts for a limited period and must be renewed. The patient is easily taught how to mold his own appliance. The gelatin mixture is brought to melting point by heat treatment in a double boiler. It is then poured into the mold and placed in a refrigera-

tor until thoroughly cooled. After its removal from the mold it is held in position by gum mastic adhesive solution.

Case x. Mrs. R., aged seventy-five years.

History. Symptoms were noticed at the age of fifty. The lesion beginning as a pimple on the tip of the nose, was later diagnosed as carcinoma. She had been treated for twenty-five years, but complete amputation of the nose was finally indicated. The operation was performed by Dr. Lyndon Peer, and was followed by radium and *x*-ray therapy. (See Fig. 10A.)

Prosthetic Treatment. A cast of the face was made employing negocoll as the impression material. On this cast a nose was molded to conform and harmonize with the other features, taking into consideration the age of the patient and using some old photographs of the patient as a guide. Over this a wax veneer was applied and when dry removed from the mold. The next step was to devise a method of retention. A flange was extended laterally with a boot effect resting on the nasal spine.

The wax and plasticene were now removed and the model reproduced in canauba for the purpose of electroforming a base to utilize tissue support. A silver base of 30 gauge was electroformed by the Hanau technique. Upon completion of this portion it was thoroughly dried under a blast of warm air. To this was attached the wax veneer which constituted the desired contour to be reproduced in the completed appliance. Over this a 40 gauge thickness of silver was laid down by electro-deposition, this completing the restoration. The wax was now boiled out leaving a hollow, light but strong appliance. All but the portion in contact with the tissues was now varnished to make it non-conducting. The remaining portion was given a heavy plate of gold. The method of coloring was the same as that employed in the ear restoration.

In this case a specially constructed pair of spectacle frames with the nose piece attached to the appliance aided in the retention. (See Fig. 10B.)

Esthetically and psychologically these prosthetic appliances are invaluable to the patient. To a great extent they eliminate the respulsive appearance of a severe disfigurement.

We again wish to emphasize the importance of cooperation between the surgeon and the prosthodontist in the care of patients with extensive facial disfigurements.

SUMMARY

1. Surgical reconstruction of missing parts is the ideal procedure when feasible.

2. Inoperable cases of cleft palate require a properly constructed obturator for the closure of the cleft and to aid normal speech.

3. Extensive malignant growths of the face when surgically removed may be temporarily or permanently covered by a prosthesis.

4. Prosthetic appliances are useful in avoiding contracture deformities during intervals of surgical reconstructive procedures.

5. In oral defects properly constructed dentures may be made to fulfil the double purpose of repairing a defect and restoring articulate speech and esthetics.

REFERENCES

Kazanjian, V. H. Dental prosthesis in relation to facial reparative surgery. *Surg. Gynec. Obst.* 59: 70–80 (July) 1934. *J. Dental Research,* 12: 651–670. 1933. Also in: Nichols: Prosthetic Dentistry, St. Louis, Mosby, 1930, pp. 471–525.

Kingsley, N. W. Oral Deformities. Appleton, N. Y., 1880.

Case, C. A. Dental, Orthopedic and Prosthetic Correction of Cleft-Palate. Chicago, Case, 1921.

Frahm, F. W. The Principles and Technique of Full Denture Construction. Bklyn., Dental Items of Int., 1934.

Dorrance, G. M. *Arch. Surg.,* 21: 185–208 (Aug.) 1930.

Jessner, J. *Am. J. Clin. Med.* (Oct.) 1922.

Axt, E. F. A case of surgical prosthesis. *Dental Cosmos* (Aug.) 1927. Vol. LXIX. No. 8 pp. 828–830.

Prosthesis as an aid to oral surgeon. *Dental Surgeon,* 1929.

Mitchel, V. E. Artificial restoration of lost or missing tissues in congenital cleft-palate and other deformities of the mouth. *Dental Cosmos,* 1917. Reprint.

RELATIONSHIP BETWEEN THE

OTOLARYNGOLOGIST AND THE PLASTIC SURGEON*

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THE plastic or reconstruction surgeon is primarily interested in reparative operations upon the exterior of the body and the restoration of functioning parts, such as repair to injuries of tendons and nerves. This leaves a special field for plastic surgery. For example, dilatation of the larynx, repair of tracheotomy wounds, adhesions of the posterior pillars of the fauces to the phrayngeal wall, the proper removal of tonsils and adenoids in a patient with cleft palate, the closure of perforations of the nasal septum, the plastic operation for either congenital or acquired atresia of the auditory canal, can very well be remedied by the expert otolaryngologist, with or without the assistance of the plastic surgeon. To these procedures may be added the correction of prominent ears and the closure of deep clefts which often result from a severe mastoid infection or from a mastoid wound which has been allowed to heal improperly. It is my belief that all of these procedures are well within the province of the otolaryngologist, and the treatment of recent fractures of the nose may be added.

MANAGEMENT (INCLUDING OPERATIVE PROCEDURES) OF REPARATIVE PROCEDURES BY THE OTOLARYNGOLOGIST

LARYNGEAL STENOSIS

Since the advent of direct laryngoscopy and bronchoscopy, many operative procedures result in brilliant success. It is not difficult for the bronchoscopist to remove any type of growth from the larynx, frequently under local anesthesia. Polypi below or above the vocal cords, papillomata on the cords, cysts, etc., are excised with precision and frequently an intrinsic malignant growth is removed from one cord, *x*-ray or radium applied and the patient is cured. Such procedures would need no discussion here if it were not for the fact that a stenosis of the larynx may result, particularly after inflammatory processes following diphtheria or the inhalation of some strong irritant.

The surgeon must confine his attention to two factors: first, the restoration of breathing and secondly, if possible, a restoration of the vocal cords so that the patient may be able to speak. Such operations are preferably performed intra-orally, If indicated, operative procedures are done but in the majority of cases, all that is necessary is repeated dilatation of the interlaryngeal space by the introduction of obturators of increasing size which have an opening in the center so that the patient is able to breathe. Complete dilatation may take place, with or without permanent injury to the vocal cords. In certain cases, the vocal cords themselves may be repaired by proper internal or external operation.

REPAIR OF TRACHEOTOMY WOUNDS

Frequently tracheotomy has to be performed as an emergency measure in cases of acute laryngeal obstruction, aris-

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ing from the inhalation of a foreign body, an acute inflammation, associated with an angina Ludovici or an angioneurotic edema, or from diphtheritic membrane in the larynx (not so often today). As a rule the tracheotomy tube does not have to remain in situ for a great length of time, so on removal, the wound is allowed to close and the cosmetic result is not unsightly. However, in chronic stenosis of the larynx and in carcinoma of the larynx, where an intrinsic growth has been removed, the tracheotomy tube has to be worn for a considerable length of time. I am not taking into account those cases where a laryngectomy has to be performed for malignancy; for in those cases the tracheal wound may have to remain open permanently.

In the type of case in which the tracheotomy tube may be removed after a short interval, an unsightly wound remains which necessitates a cosmetic operation, for not only is the wound indented but there is an opening into the trachea which has to be closed.

Operative Procedure. After thorough cleansing of the parts, the skin and underlying tissues are anesthetized by injections of 1 per cent novacain and adrenalin. The edges of the wound are freshened and the trachea is separated from the superficial tissues. It is now possible in the majority of cases to close the tracheal wound, and this may be done if there is assurance that no narrowing will follow. The skin and deeper tissues are widely separated from the underlying parts. The edges of the old wound are freshened and brought together horizontally and then sutured with fine silk. The wound heals rapidly and as a rule by primary intention.

PHARYNGEAL ADHESIONS

A congenital abnormality may occur but this is rare. Adhesions of the posterior pillar or pillars of the tonsils to the pharyngeal wall may result from an improperly performed tonsil and adenoid operation. Such accidents do not take place as often today as they did in former years but such cases are occasionally seen by the otolaryngologist. I have seen many malformations of the throat due to operations done by men who had no right to operate. These malformations extend from the moderate adhesion of one pillar to the pharyngeal wall to a complete closure of the nasopharynx where the tissues have been so torn and maltreated that there are no remaining normal anatomical relationships. However, such a condition may result from tuberculosis or syphilis of the nasopharynx. In fact, considerable destruction of tissue, with adhesions, is associated with syphilis.

Symptoms of such a condition may be insignificant or may become so serious that they interfere with the normal vitality of the individual. Nasal breathing is difficult or impossible, there may be difficulty in swallowing or the patient may complain of a stiffness of the throat. One easily sees what the difficulty is on local examination of the patient.

Parenthetically it may be mentioned that extreme deformities of the throat, most often due to mutilating operations, may give rise to no symptoms whatsoever. Years ago, at the New York Academy of Medicine, the question of tonsil operations in singers was discussed. Many men had been of the opinion that distortion of the throat, adhesions after operation, etc. would interfere with the singing voice. The members of the Laryngological Section brought together an array of professional singers who had had tonsil operations and who had, as a result, deformed throats, extending from an amputated uvula to definite adhesions between the pillars and the pharynx. In every instance the voice was as good as ever.

Consideration for Operation. Examination of the throat reveals the extent of the deformity. Where there is fair breathing, the patient is in good physical condition, no alteration in the voice, the patient is able to swallow normally and has no feeling of anything abnormal, nothing should be done. In other words just seeing the ab-

normal condition is no reason for performing an operation. I have one patient who has an opening into the nasopharynx no larger than the calibre of an ordinary lead pencil, and has no symptoms. At forty years of age, he is still perfectly normal. In other cases, it is absolutely essential that something be done.

FIG. 1A. FIG. 1B.

FIG. 1. Saddle back nose due to removal of too much septum. (From Safian's Corrective Rhinoplastic Surgery.)

Operation for Pharyngeal Adhesions. It is of primary importance to map out a procedure in which the adhesions are freed and also to be able to cover the denuded surfaces with new mucous membrane, to avoid formation of new adhesions. As an anesthetic of preference the patient is given avertin by rectum, supplemented by a local anesthetic of novocain and adrenalin. The adhesions are freed by sharp dissection until one is sure that there is sufficient motility and nasal breathing space. The amount of denuded area may be considerable and the next problem is to find sufficient mucosa to cover the raw, denuded space. After it is properly filled in it is sutured into place with fine catgut or silk. This procedure is by no means easy and particular care must be taken that the denuded surface of the soft palate and the posterior pillars is covered. After this is accomplished satisfactorily, attention must be given to the cheek wound. The edges of the cut mucosa are freed from the deeper tissues until they can be approximated without tension and then they are sutured with fine catgut.

As a rule, the wounds heal readily. One continues to keep the mouth clean and antiseptic. Food is given by rectum for three days. The patient is cautioned not to swallow any more than is necessary. The wounds are inspected daily. At the end of the fifth day the patient is free from any danger of infection.

REMOVAL OF TONSILS AND ADENOIDS IN PATIENTS WITH CLEFT PALATE

Infrequently patients with cleft palate have enlarged tonsils and sometimes adenoids which have to be removed. It is of the utmost importance that such an operation be performed with unusual care so that as little as possible of the soft tissues which surround the tonsils be disturbed. There are two types of cases: (1) in very young individuals who have not had a cleft palate operation performed and where one is contemplated; and (2) adults who have worn an obturator or prosthesis which fits

properly. If soft tissue is sacrificed by a poor operation, the dental plate will not fit. I have taken care of both types of cases.

Fig. 2. Saddle back nose due to removal of too much septum. (From Safian.)

In the former group of cases, the otolaryngologist must regard the throat from the viewpoint of the surgeon who is to repair the palate cleft. A thorough examination must be made of the relationship of the anterior and posterior pillars of the fauces to the tonsil. The dissection must be made with the utmost care so that, after the tonsil is removed, the pillars hang loosely so that they may be utilized later. Care must also be used in removing the adenoids so that there is no opportunity for adhesions to form.

In the second group of cases, when the obturator is removed, one can see high up in the vault of the nose. The tonsils are not in a normal position; as a rule they hang loosely and extend down into the hypopharynx. There is a tendency to pull on the pillars so that they are distorted and out of position. There is always a possibility that even with the most skilful operation, a laxity of the pillars will take place so that the obturator will not fit properly later. The tonsils must be removed, preferably by dissection; special attention must be paid to the pillars so that they maintain the same position after operation as they did before.

Fig. 3. Dropping of tip of nose due to improper septum operation. (From Safian.)

HARELIP CASES WITH NASAL OBSTRUCTION

Obviously the plastic surgeon should operate upon the majority of patients. There are certain cases in which the cleft extends into the nose so that one nostril is narrower and a definite nasal obstruction is made worse because of deviation of the septum to the distorted side. The harelip operation should be performed at an early age, but the nasal obstruction should not be operated upon until after puberty if it is possible to wait that long. The obstruction is usually in the inferior meatus and is due to a dislodgement of the vomer from its normal groove at the time of birth. Metzenbaum of Cleveland pointed out the fact that in many patients who do not have cleft palate dislodgement of the septum occurs at birth. If one is aware of the fact that such an obstruction has taken place it can easily be corrected at that time. All one has to do is to slip one's finger or

some dull instrument into the affected side and lift the septum back into its normal groove.

cartilage. The operation is preferably performed in a hospital. All hairs should be cut off. Iodine should be applied to the part

FIG. 4A. FIG. 4B.

FIG. 4. Author's case. (From Safian.) A. Appearance following automobile accident. Probe extending from external wound through nose. B. Case after operation by Dr. Joseph Safian.

If the obstruction persists until puberty, the otolaryngologist can operate on the septum. We shall take it for granted that the narrowed nostril has been enlarged, therefore only as much of the septum as is causing obstruction should be removed. As was stated, this defect is usually in the inferior meatus and forms a hard bony obstruction. After the underlying mucosa is freed, the bone is removed with a hammer, chisel and sometimes a saw, and the mucosa then replaced. Since there is a redundancy of mucosa it does not matter if some of it is destroyed. The utmost care should be taken to see that there are no denuded parts.

DEFLECTION OF THE TRIANGULAR CARTILAGE

This operation is so simple that very little space is needed for its description. The offending nostril may be seen to be almost, if not completely obstructed by the and then it should be anesthetized with novocaine. The incision should be made over the most prominent part and continued down to the cartilage. The dissection behind and in front of this is not always easy because there are three to four layers of very adherent tissue but it can be accomplished with a sharp scalpel. After the cartilage is denuded, an incision is made through it, the parts on the other side freed and the obstruction removed. In many instances one will see a deviation of the septum which could not be seen before but this should be left alone if the breathing seems to be free. After the obstruction has been removed, the edges of the incision should be brought together with fine black silk sutures which are allowed to remain in place for five days. If the wound is not sutured, a denuded area is apt to remain or a perforation of the septum may occur; for the mucosa on the opposite side is very thin.

PERFORATIONS OF THE NASAL SEPTUM

Such an accident is quite common and is frequently the result of a septum operation. Primary perforations of the septum are most unusual. This condition may arise from continually picking the nose to remove crusts, or may be due to disease, either tuberculosis or syphilis. Most septal perforations resulting from septum operations, can be attributed to occasional imperfectly performed operations, and other times because the mucosa is so thin that it tears, regardless of the utmost care at the time of operation.

Perforations divide themselves into two main classes: the large and the small. Large perforations do not cause as much trouble to the patients as small ones. The main complaint is constant crusting of nasal secretions. It is seldom possible to repair these large perforations. As suggested by Skillern, at times a large opening in the septum is purposely made for certain types of sinus disease. The small perforation, from the size of a pin head to a centimeter in diameter, is a definite nuisance, mainly because it causes a whistling sound whenever the patient breathes through his nose.

Operation. If these perforations are in the anterior portion of the septum, they are not extremely difficult to correct. After proper anesthetization, one attempts to separate the mucosa and underlying soft tissues, both anteriorly and posteriorly to the perforation. Then one penetrates the edges all around until the tissues are free. The edges of the perforation are freshened and then coapted with fine sutures. The suturing is not very easy and has to be performed with a modified aneurysm needle. The sutures may be removed at the end of five days. As a rule, no packing is necessary.

In certain cases, in which there is tension of the tissues after they are freed, an incision of some extent may be made above and below the perforation. The denuded parts will eventually heal.

SADDLE NOSE RESULTING FROM IMPROPER SEPTAL OPERATIONS

Naturally the correction of such a deformity should be left to the competent plastic surgeon. The chief reason for bringing it to one's attention here is to warn the otolaryngologist that he should be unusually careful in performing a septal operation so that such a disastrous deformity, does not take place.

In studying the anatomy of the nose, one realizes that the septum is the main support of the nose and has a great deal to do with its external appearance. The most prominent part is held in place by the conformity of the cartilaginous portion of the septum, particularly the upper part. The bony portion of the septum can be mutilated to a great extent without causing any trouble.

The tip of the nose may lose its normal appearance by too extensive an operation on the triangular cartilage (Figs. 1 and 2). The upper portion of this cartilage holds up the tip of the nose; if this is removed, the tip will drop. Therefore, in performing this operation, care must be taken not to remove the upper portion of this cartilaginous septum.

We are mainly concerned with saddle nose. A saddle nose of the extreme kind may result from many causes, as injuries, syphilis, etc. The sunk-in nose with which we are concerned is the depression which occurs in the lower portion, just below the junction of the two nasal bones. This is almost invariably caused by an improperly performed septal operation.

Otolaryngologists must realize that a septal operation should be performed for two purposes only: to give proper breathing space and to give proper drainage to the sinuses. Only as much of the septum as is necessary should be removed and one should never make the attempt to remove the entire septum, particularly the triangular portion. One may remove all he wishes of the lower cartilaginous portion of the septum but should beware of the

upper portion. It is surprising how the removal of any part of the supporting septum will result in a cave-in of the nose (Fig. 3). It is preferable to allow a small, deviated part to remain than to excise too much and leave a nose which will sink within a short time and require plastic repair.

EXTERNAL SINUS OPERATIONS WITH DEFORMITY

The otolaryngologist is mainly concerned with getting the patient well and seldom thinks of the marred features which will result from the operation and which will be a constant embarrassment to the patient. Sometimes one cannot concern himself, but at other times, it is possible to pay more attention to the suturing process. Of main concern is the depression which arises from an extensive frontal sinus operation. This may be overcome in many instances by a thorough examination of the *x*-ray plates and adapting the procedures to the amount of bone involved. I have seen cases in which there was little disease of the external plate and yet the entire bone was removed from the external to the internal canthus. In such cases, only a small opening into the frontal sinus need be made. After the process of the disease has ceased, the external wound will heal without resulting scar, particularly if the original wound is made through the eyebrow. Where an extensive operation has been performed, particularly if it is necessary to make a butterfly incision over both frontal sinuses, an unsightly scar must necessarily develop. Later a plastic operation may be performed or a proper prosthesis applied.

ACUTE NASAL FRACTURES

Extreme deformities, the result of severe injury to the nasal bones and often of the surrounding parts, may be cared for more properly by the plastic surgeon. But he may not be available and very often such injuries will have to be handled by the general practitioner.

As a rule, it is wiser not to make any attempt to adjust the injured parts at the time of the immediate injury and particularly so when there are external wounds. The nasal hemorrhage is often severe and if there is a fracture of the septum there may be an extravasation of blood on one or both sides of the septum. Such a hemorrhage must be stopped immediately both as a matter of convenience to the patient and because one must avoid the formation of a submucosal "blood tumor" which may later cause a permanent obstruction. The usual procedures for arresting nasal hemorrhage should be applied. If packing one or both of the nasal cavities is necessary, it should be done with extreme care. Better results are obtained if the nose is washed out thoroughly with a hot saline solution (106–112°F.) to which is added a small amount of suprarenalin extract. In fact, the hemorrhage may cease, without packing, if the nose is properly washed out.

Attention should now be paid to the external swelling. This is best reduced by the application of iced compresses. If external wounds are present, it is far better not to attempt suture for twenty-four hours so that infection may be eliminated. Then the edges should be carefully examined and, if possible, they should be carefully approximated with fine silk sutures.

Two definite problems present themselves: (1) attention to intranasal injuries and (2) attention to external deformity. If one finds a fracture of the septum, particularly if there is a severe extravasation of blood, resort to packing of the nose as soon as possible. The routine packing of the nose, usually with iodoform gauze, is crude and is often unskilfully done. The best way to pack the nasal cavities is to take folds of ¼ inch gauze (iodoform, bismuth or plain) about 2 inches long. Place the first packing in the inferior meatus and then apply further folds of gauze, one on top of the other, until the cavity is tightly filled. Care should be taken to exert pressure upon the septum in order to eliminate any tendency toward excessive hemorrhage.

The actual fracture of the nasal bones themselves must receive especial attention. Such fractures fall into a number of classes and the treatment given will depend upon the extent of the fracture and the resulting deformity. The simplest type is the comminuted fracture or greenstick fracture with no deformity. Very slight or no crepitation will be felt on palpation, and the fracture may be ascertained only by *x*-ray picture. No treatment to the fracture itself is necessary. Other types vary from the depressed fracture or one which causes the nose to be forced to one side, to that with external wounds or complete destruction of the nasal bones.

After the external swelling has subsided to some extent, an attempt must be made to bring the bones into proper alignment before there is an opportunity for the bones to "set" in a wrong position. The patient should be given a general anesthetic. A blunt instrument is placed in the nasal cavity on the side of the depressed bone and the fragment elevated to its normal position. In many cases this is possible. If the entire nose has been forced to one side, forcible manipulation may be necessary to adjust it properly. A small pad should be placed against the fractured bone and held in place with adhesive tape. At the same time, a nasal packing should be placed high up in the nose to hold the fragment in place from the inside. This should be left in place three to four days. Generally, the nose will take care of itself after that. If there is still evidence of deformity, the patient should be referred to a plastic surgeon of repute for further care.

ACCIDENTAL INJURIES

Numerous types of injury of this kind are seen today, because of the automobile. The otolaryngologist, as well as the general practitioner, must be in a position to take care of such patients. No general or specific rules can be laid down. In many instances, immediate surgery is necessary—surgery which cannot attempt to pay attention to cosmetic results.

One automobile accident case seen presented a fracture of the nose, the malar and frontal bones and injury to one eye (Fig. 4). There were numerous external wounds. Attention was paid to the injuries at the time of the accident. The wounds were sutured, the malar and frontal bones lifted into position and an attempt made to bring together the fragments of nasal bones. The deformity, especially to the nose, was considerable. Dr. Safian performed a reparative operation at a later date.

PROTRUDING EARS

Very prominent ears, standing well out from the head, often need attention. The operation is comparatively simple and can readily be performed by the competent aurist. A semilunar incision is made behind the ear, under either local or general anesthesia. Dissection of the soft tissues is carried down to the ear canal and backward under the scalp until they are loose. The proper amount of soft tissue is excised and the free edges of the wound sutured. A bandage is kept on for a few days and then the sutures removed. The results are uniformly good.

REPAIR OF CAVITY DEFECTS AFTER MASTOID OPERATION

In former times, when mastoid wounds were packed and left open, unsightly cavities behind the ear often resulted. Such a condition also arises today in those cases where wounds will not heal properly or where it is necessary to leave the mastoid cavity wide open because some complication has occurred. The patient does not complain so much about the cavity as of the dirt which accumulates in it and which has to be cleaned out from time to time. In certain cases, a sinus leads down into the antrum and middle ear so that the cavity is constantly moist from secretions which come up from the throat through the eustachian tube. This results in crust formation which is extremely annoying.

The problem is to close this cavity, both for cosmetic reasons and to rid the patient of the annoyances. Preferably under avertin and local anesthesia, the parts are thoroughly cleansed of all foreign material. The thin skin which lines the mastoid cavity is carefully dissected from the underlying bone. The soft tissues are completely freed anteriorly and posteriorly. The anterior dissection must be carried down to the posterior canal wall. The posterior dissection is continued for at least 1½ inches. However if the tissues were then brought together there would be too much tension. Therefore a second incision is made in the scalp, at least 1½ inches behind the mastoid wound and carried down to the bone. This is made sufficiently long so that the section of scalp can be slid forward. The edges now overlying the mastoid cavity are sutured with some strong material. Dissection of the scalp is then continued posteriorly until there is sufficient loose tissue to bring the edges of the second wound together without any tension. A regular mastoid bandage is applied. Healing takes place in five to six days when the sutures may be removed. As a rule, the cosmetic result is excellent and what pleases the patient most is that there is no further secretion from the middle ear.

ATRESIA OF EAR CANAL

Atresia of the ear canal may be either congenital or acquired. Atresia may be only of the cartilaginous portion of the canal or may involve the bony structures.

In cases of congenital atresia, it is necessary to determine whether the closure of the canal involves the bony structure or not and also whether any middle ear is present, particularly if marked deafness is also present. In congenital cases where the bony structures are definitely abnormal, the condition cannot be corrected. Where the closure is in the anterior part of the canal involving only the soft structures, it is frequently possible to correct the condition. This is essential in patients who have functioning middle ears, because normal or nearly normal hearing may be restored if the atresia is properly corrected.

Such atresia may be caused by a thin membrane which has developed in the ear canal, completely occluding it. In these cases the operation is very simple because the membrane is easily excised. In other cases the canal is completely closed off by cartilage, skin and inner lining mucous membrane. A plastic operation has to be performed. An incision is made behind the ear and extended down to and through the posterior cartilaginous canal wall. As much of the obstruction as possible is removed until one obtains a good view of the drum membrane. The type of reconstruction of the canal will depend upon the individual case. In every instance it is necessary to obtain flaps of cartilage and skin to line the new canal. After these are retained in place with catgut sutures, the ear canal is firmly packed with gauze which is kept in place until such time as definite adherence has occurred.

Acquired atresia may result from chronic eczema of the ear canal or multiple furuncles which result in chronic inflammation. Such a condition may arise from an accident to the canal wall but most frequently a partial or complete atresia results from a mastoid operation in which too much of the bony posterior canal wall had been removed and permitted a prolapse of the membranous wall with a more or less complete closure of the external auditory apparatus.

Operation may have to be performed to correct such a condition. Again an incision is made behind the ear and extended down until the narrow part is brought into sight. The operation will vary according to the condition. One proceeds in the same manner as in making a plastic flap after a radical mastoid operation. An incision is made behind the ear and as much as possible of the underlying cartilage is freed from the skin. This leaves a loose flap of tissue which can be sutured into place so that a new auditory canal can be made as large as one wishes. In the course of time

the denuded parts are covered with granulations and the external appearance of the ear is not changed.

CONCLUSION

Although one realizes the necessity for referring the majority of patients needing plastic repair to the plastic surgeon, it will be seen from the procedures here outlined that there are certain definite cases which have to be attended by the otolaryngologist and occasionally by the general practitioner.

It is my sincere hope that I have made certain conditions sufficiently clear to the reader so that he will be able to handle such cases in an intelligent manner.

REFERENCES

Babcock, W. W. Plastic closure of laryngotomic fistulas and enlargement of the lumen of the trachea or larynx by implantation of a chondrocutaneous flap. *Arch. Otolaryng.*, 19: 585–589, 1934.

Bickham, W. S. Operative Surgery. Phila., Saunders, 1924, 3: 305. (Closure of perforations, Hazeltine's technique.)

Harris, T. J. Adhesions after tonsillectomy. *Laryngoscope*, 30: 471, 1920. (Presentation of a case.)

Jackson, C., and Babcock, W. W. Plastic closure of tracheotomic fistula. *Surg. Clin. North America*, 14: 199–202 (Feb.) 1934. (Adhesions of posterior pillars to pharyngeal wall after tonsillectomy. Operations for same.)

Keeler, J. C. Modern Otology. Phila., Davis, 1930, pp. 149: 152.

Kopetzky, S. J. Otologic Surgery. Ed. 2. N. Y., Hoeber, 1929, pp. 46–51.

Lischkoff, M. A., and Heinberg, C. J. A new procedure for the closure of non-specific perforations of the nasal septum. *Arch. Otolaryng.*, 14: 342, 1926.

MacKenty, J. E. Nasopharyngeal atresia. *Arch. Otolaryng.*, 6: 1 (July) 1927. (Operation for closure of perforations of nasal septum.)

Richards, L. Congenital atresia of the external auditory meatus. *Ann. Otol., Rhinol. & Laryngol.*, 42: 692–711, 1933. (Bibliog.)

Safian, J. Corrective Rhinoplastic Surgery, N. Y., Am. J. Surg., 1934.

Sewall, E. C. Perforations of the septum. In: Jackson, C., The Nose, Throat and Ear and Their Diseases. Phila., 1930, pp. 77–79.

Tod, H. F. Operations upon the ear. In: Oxford Loose-Leaf Liv. Surg., 4: 327–510, 1920. (Atresia, pp. 354–355; illus. p. 426.)

BURNS*

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THE causes of the severe shock and toxemia following burns is a much discussed question.

Robertson and Boyd[1] in a series of experiments found that the burned skin of a rabbit grafted upon a healthy animal caused the latter to present a typical picture of acute toxemia. They found, too, that the injection of blood from a burned child into a healthy animal caused a similar reaction. When the blood serum of a burned animal was injected into a normal animal there was very little reaction, while the injection of the red blood cells produced a violent reaction. They conclude from their experiments that in the burning of living skin toxins are produced and that the absorption of the toxins is the cause of shock and death and they further conclude that the toxins are carried by the red blood cells.

However, A. E. Osterberg[2] states that

> There seems to be no scientific evidence of absorption of toxins theoretically produced by the burning of tissue since extracts of burned tissue have never been shown conclusively to produce a toxic reaction, nor has the blood of animals or patients suffering from burns been shown to contain a circulating toxin.

He further states that "it would seem that the clinical picture observed in cases of extensive burns is due to excessive concentration of blood with its resultant phenomenon, and not to specific toxins produced as a direct result of the burning of tissue."

Weiskotten[3] from his observations and studies concluded that the toxemia and shock following burns are the result of damage to the adrenal glands.

There appears, therefore, a wide divergence of opinion as to the cause or causes of shock and death following burns. The solution is not at hand.

Ravdin[4] believes that toxins are rapidly formed in burned tissue and that, in order to prevent toxemia, all burned tissue must be removed within eight hours. He advises early debridement of the burned area.

In Germany, Reschke[5] favored the theory of toxic absorption and he treated burns by giving the patient a general anesthetic and scrubbing the burned area so as to remove all burned tissue. He then painted the part with absolute alcohol and applied a hypertonic salt solution as a wet dressing.

McCullough[6] favored the removal of toxins from the blood stream by exsanguination and transfusion. He advised removal of 20 c.c. of blood for each pound of body weight and the transfusion of a like amount from a suitable donor.

All agree that there is a loss of body fluids associated with extensive burns. Accepting all the theories advanced, the duty of the doctor is twofold: (1) to prevent the absorption of toxins; (2) to maintain the body fluids.

TREATMENT OF BURNS

In this paper I shall not stop to classify burns as to the degree or causative agents, except to say that electrical contact burns are the deepest, most localized, most painful and the slowest in healing.

The primary treatment of all burns should be directed toward combating shock. In the presence of shock no attempt

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should be made to treat the burns. Shock is best treated by:

(1) Relief of pain
(2) Maintenance of body heat
(3) Posture
(4) Administration of fluids.

Narcotics should be given freely until there is complete relief from pain. Morphine, codeine, and luminal are favored. The dose is dependent upon the size of the individual and the age of the patient. All annoying external stimuli should be removed. The patient should be put to bed and the foot of the bed elevated. A cradle over the patient and especially over the burned area is advisable. Blankets should cover the patient and the cradle. There should be suspended from the cradle a number of electric light bulbs to help maintain the body heat.

Fluids should be administered by every avenue. If the patient can be made to drink, by mouth; otherwise, the skin, the rectum and the vein should be utilized. The fluids recommended are: (1) Glucose 5 per cent solution for intravenous administration or 3 per cent under the skin. (2) Two per cent solution of bicarbonate of soda may be given either under the skin, by vein or into the rectum. (3) Normal salt solution may be administered in a similar manner. Fluids should be given in amounts varying from 2000 to 8000 c.c. in twenty-four hours.

The transfusion of whole blood from a suitable donor in amounts varying from 250 to 500 c.c. has been found of great value, not only in the maintenance of body fluids but also in overcoming toxemia and infection.

The local treatment of burns has never been standardized. Today, the methods are many and varied. It is only a short time since burns were treated by the application of a solution of picric acid. The results were not satisfactory and picric acid has been discarded. Alcohol, a 2 per cent solution of aluminum acetate, a solution of adrenalin 1:10,000 and debridement have all been used and discarded. Various dyes are now being used but my experience with this type of treatment is so limited as to allow no conclusion. The two types of treatment used by us are:

(1) Tannic acid method as suggested by Davidson with modifications.

(2) Ten per cent solution of sodium bicarbonate as strongly advocated by Moorhead.

TANNIC ACID METHOD

The treatment of burns by tannic acid is not new. It was a practice of the Jews to treat burns by the use of ink when inks were made from tannic acid and not from coal tar products as they are today. The Chinese are said to have used a strong brew of tea which contained tannic acid as their treatment for burns. The tannic acid treatment as used today was first introduced by Davidson of Detroit in 1925. He employed tannic acid because of its property of precipitating proteins and limiting decomposition. He felt that if it would precipitate toxic substances in burned tissue, the absorption of such toxins would be prevented and decomposition retarded. Tannic acid should always be used in a freshly prepared 5 per cent aqueous solution. Such a solution is easily made. When left standing, it breaks down readily and rapidly into gallic acid and it is, therefore, necessary that only fresh solutions be used.

Recently, the addition of a 4 per cent solution of glycerin in water and 1:2000 solution of acriflavine to the tannic acid solution has been advocated. It is claimed that by the use of glycerin, the coagulum is made more flexible and that the acriflavine has some antiseptic property.

Method of Procedure: The burnt area is cleansed. Grease and grime are removed. All blebs are opened and the superficial dermis removed. With an atomizer or flit-can the burnt area is entirely sprayed with the tannic acid solution. The spraying is repeated every fifteen to thirty minutes

until the part has assumed a dark mahogany or almost black color. This should occur in from ten to eighteen hours. The part is not bandaged. A cradle is placed over the patient so as to keep the bed sheets and covers off the part. To maintain warmth, electric lights are suspended from the cradle over the part. No attempt is made to lift the coagulum unless there are signs of infection underneath. Should infection develop, it is a very simple thing to cut out squares or punch holes into the leathery mass and allow for the free egress of pus. The coagulated mass has a tendency to separate itself from the healthy tissue and in from ten days to three weeks this separation is complete. When the coagulum is finally separated the underlying tissue is covered by a thin film of exudate which when wiped away shows, as a rule, a granulating area. At this time an effort should be made to cover the granulating surface with skin. This phase of treatment will be discussed later. The coagulum limits the loss of body fluids. It prevents irritation of the inflamed surface and is a protection from outside impulses. It also acts as a trellis over which epithelium may be carried. Tannic acid treatment allows of greater comfort to the patient and permits easier handling of the patient.

BICARBONATE OF SODA METHOD

The part is cleansed. If a large area of the body is involved, the patient is immersed in a bath tub containing a 10 per cent solution of bicarbonate of soda. The solution must be warm. The patient can be immersed for a considerable time without any ill effects. A wet dressing of the bicarbonate of soda solution is used when the patient is not in the bath tub. When the wet dressing is used a cradle, from which a number of lights are suspended, is placed over the part. Within three weeks all sloughs have usually separated and a clean wound is noted. The part is then ready for skin grafting.

GENERAL CARE

Throughout the period of treatment and convalescence, it is absolutely essential to maintain the body fluids. In children, guard against acidosis. Blood chemistry is a great aid in the treatment of burns and should be utilized. In the presence of persistent vomiting with the resultant loss of chlorides, intravenous administration of a hypertonic salt solution is advisable. In septic cases, repeated transfusions are valuable.

FACE BURNS

There is nothing so annoying as the absolutely blank expression on the face of a person who has suffered from burns. The absence of the normal wrinkles is a serious facial disfigurement. How often one sees an active, keen brain and a face that appears dull and expressionless. It is essential to keep in mind the necessity of preventing facial scarring and the loss of normal wrinkles.

We treat burns of the face by putting an application of 10 per cent solution of bicarbonate of soda over the entire face. The solution is applied to a gauze mask which is always kept wet. The conjunctivitis, which is invariably present, is treated by the application of boric acid compresses to the eyes, the instillation of a drop of 10 per cent argyrol twice daily and the application of an ointment of 1 per cent yellow oxide of mercury to the eyelids at night. As soon as the active inflammation has subsided, boric acid ointment is applied to the entire burnt area and is not covered by any form of dressing. It is allowed to remain in place all day and at night a dressing is applied.

Moorhead advises early facial gymnastics and he strongly recommends the chewing of gum. Immediately upon admission to the hospital the patient is supplied with a package of chewing gum and advised to chew as much as he possibly can. He is urged to wrinkle his forehead, furrow his brow, blow out his cheeks and to use

all the muscles of his face. These exercises are repeated several times daily and, for the most part, under the supervision of a doctor. We believe such gymnastics prevent, in a large measure, the loss of the normal wrinkles of the face and facial scarring.

HEALING AND SKIN GRAFTS

When the stage of repair sets in it is well to have the part exposed to fresh air and sunshine. The granulations must be clean and healthy for the reception of skin. It is often necessary to stimulate the granulations and we advise in addition to fresh air and light, the use of equal parts of scarlet red ointment and olive oil as a dressing to the wound at night. No time should be lost in covering healthy granulations with skin. Early grafting is a most efficient preventive against absorption, thickened scars, deformities and disfigurations. Too long a delay is followed by chronicity and scar tissue. It is common for children with large burnt areas in the granulating stage to run temperatures and it is extremely gratifying to note how quickly the temperature drops and the patient's condition improves after the area is covered with healthy skin.

Skin should not be grafted upon scar tissue nor chronic and anemic granulations. All such contractures and chronic scars must be excised before skin grafting is attempted. The anesthetic used in the skin graft operation will depend upon the patient, the area to be grafted and the personal likes of the surgeon. I believe that an anesthetic should always be used. The area from which the graft is taken is prepared by painting it with tincture of iodine 3½ per cent and flushing with alcohol. The area to be grafted should be painted with alcohol. Hot compresses should be applied and if there is any tendency toward scarring or unhealthy granulations the part should be gently curetted. There should be no active bleeding but a generalized redness giving an appearance of rare roast beef.

Types of Grafts. When small areas are involved the surrounding skin may be undermined and the freshened edges of the wound sutured with interrupted dermol sutures. If the edges of the wounds can not be easily approximated then releasing incisions to either side of the wound and at some distance therefrom should be employed. The following types of grafts may be used: (1) Thiersch, (2) Wolfe, (3) pedicle, (4) tubular, (5) pinch.

The type of graft is dependent upon the conditions to be met and the site of the area to be grafted. Autografts are best. Grafts taken from a donor are not advised since such grafts as a rule disappear rapidly. If it is necessary to use a donor then absolute care should be exercised that the blood of the recipient and donor are in the same group and compatible.

To describe in detail all the methods of grafting would require a volume in itself. Some salient points are here described.

Thiersch grafts are probably the easiest to apply. They have a tendency to contract, crack easily and are usually off color. They give the poorest cosmetic result. In performing a Thiersch graft it is necessary to hold the skin tense. A broad extremely sharp razor is immersed in salt solution and as thin a layer as possible of epidermis is removed. The graft should be as large as possible. It will be noted that the graft lies in folds on the razor blade. The razor is then brought to the wound with the sharp edge held close thereto. The graft is fixed with a large needle held in the hand of the operator and the razor is slowly drawn away so that the graft slides off and lies flat on the wound. The graft must be smooth. This operation is repeated until the entire wound is covered. The grafted area is then covered with mesh gauze which has been soaked in albolene. A large dressing is then applied and bandaged firmly in place. If the graft is upon an extremity it is well to incorporate the part in a light plaster-of-Paris case. The graft should be allowed to stay in place for from two

to three weeks. At the expiration of that time the dressing should be carefully removed.

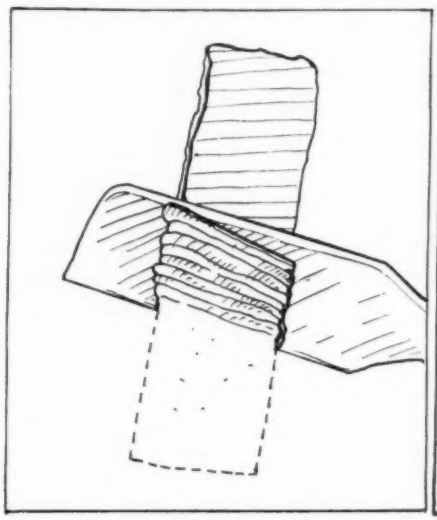

FIG. 1. Removal of Thiersch graft.

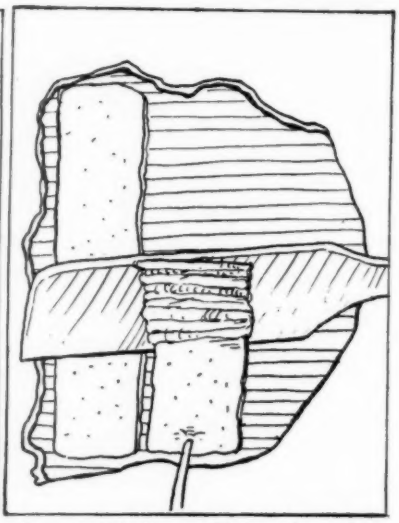

FIG. 2. Placing of Thiersch graft.

Wolfe Graft. The Wolfe graft contains all the dermal elements and as a result remains soft and natural in color. An exact pattern of the area to be grafted is made. The pattern is placed upon the area of skin in a suitable region and an outline about one-sixth larger than the defect is traced upon the skin with a scalpel. The skin is then cut and the flaps separated from the surrounding tissue. All fat from the under surface of the graft is removed. The graft is then fitted into the defect and held in place with a number of interrupted fine dermal sutures. Gentle but firm pressure is made upon the graft and a dressing is applied.

Pinch grafts have been found to be most useful in covering areas upon the extremities. A straight needle is inserted into the skin (usually one of the thighs), transfixing it in the shape of a cone, the base of which is about ¼ inch in diameter. With a razor blade held in a straight clamp, this raised skin is amputated. The small graft is then placed upon the granulating surface. This operation is repeated until the entire area is covered. The grafts should be about ¼ inch apart. We have made it a practice to close the wounds with No. 0 catgut and cover the wounds with sterile vaseline gauze. The grafted area is protected by wide gauze which has been carefully soaked in albolene and a dry gauze dressing is placed over the part. The part is encased in plaster-of-Paris for two to three weeks.

Flap grafts should consist of whole thickness of the skin and some of the subcutaneous fat. The pedicle should be wide enough for nourishment to be freely supplied. There should be no twisting or tension on the pedicle. This graft may be sutured in the form of a tube and allowed to remain in place until there is definite certainty that the circulation is good. It may be then transferred in stages to a distant site making certain with each transfer that the graft is viable. The graft may be allowed to remain perfectly flat but it has been found that there is less absorption and less likelihood of infection in the tubular type of graft.

The flat flap graft is particularly useful in covering defects of the hand or forearm or even the leg.

A place from which to take the graft is chosen on the front of the abdomen or chest. The place decided upon should permit of keeping the hand, forearm and arm supported without strain and in comfort. Then two parallel incisions are made in the area chosen. The skin is undermined and a flap with an upper and

lower pedicle is formed and held. The skin on either side of the wound is then undermined and the wound edges approximated with dermal sutures. The wound is covered with a dressing. The hand is then brought under the flap and is adjusted into place. The flap is sutured to the denuded area with interrupted dermal sutures. A dressing is lightly applied and the part fixed in place by adhesive strapping. In two weeks the lower end of the flap is partly cut across. If there is free bleeding from the flap the incision is continued and the flap separated. If the bleeding is not satisfactory, a dressing is applied for one week. Another incision is then made and as a rule, there is free bleeding. When completely separated the flap is trimmed and fixed to the denuded area. If the palmar surface of the wrist or forearm

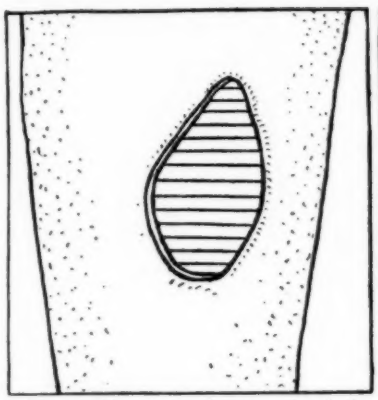

Fig. 3. Area to be repaired by Wolff graft.

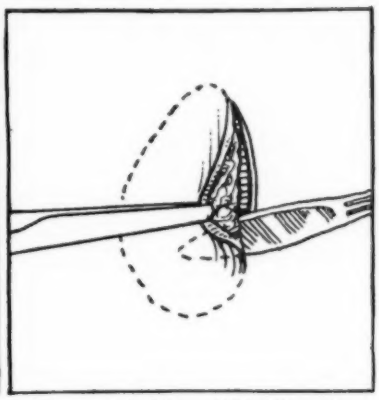

Fig. 4. Making of Wolff graft.

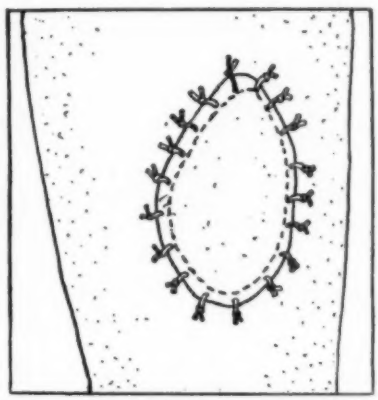

Fig. 5. Defective area covered by Wolff graft.

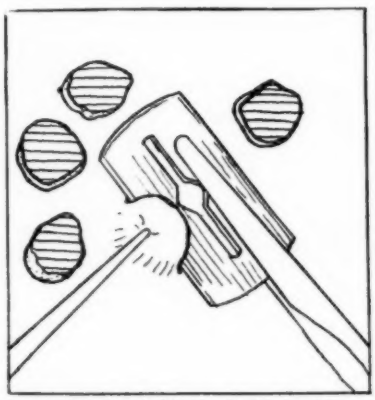

Fig. 6. Taking pinch graft.

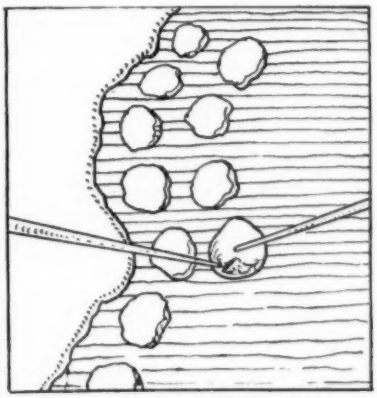

Fig. 7. Placing pinch grafts.

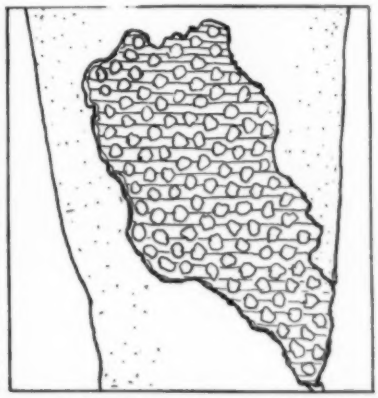

Fig. 8. Pinch grafts covering defect of thigh.

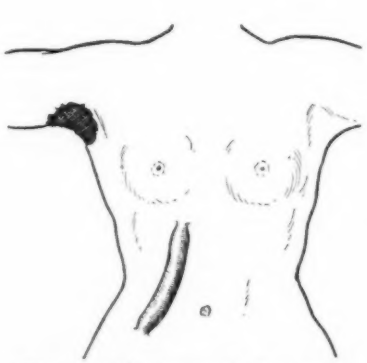

Fig. 9. Tubular graft first step.

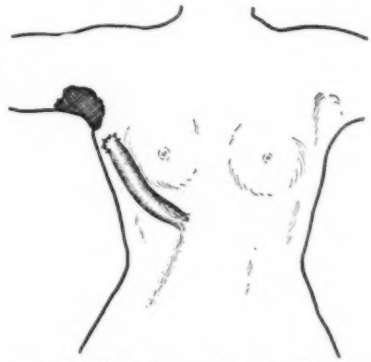

Fig. 10. Tubular graft second step.

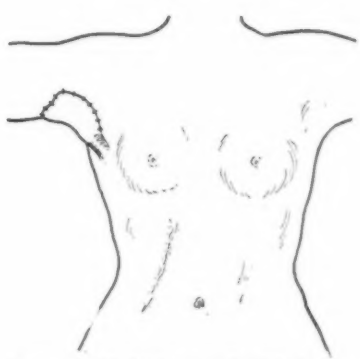

Fig. 11. Tubular graft third step.

is involved, the flap should be made on the back.

There are various other methods of flap grafts of which space will not permit a description. It is necessary to remember that in all flap grafts there must be no separation of the flap until the circulation is satisfactory. In the tubular grafts a series of two or three or even four operations may be necessary. The period of time consumed in finishing this type of operation is of necessity somewhat extended.

In conclusion may I make a plea for the avoidance of contractures following burns. It is far easier to prevent such contractures than to cure them. Burned tissues always have a tendency to contract and it is necessary to bear the fact in mind in placing an extremity in a position of election. Burns upon the flexor surface should be put in extension and vice versa. With burns in the axilla, the arms should be put in hyperabduction and burns

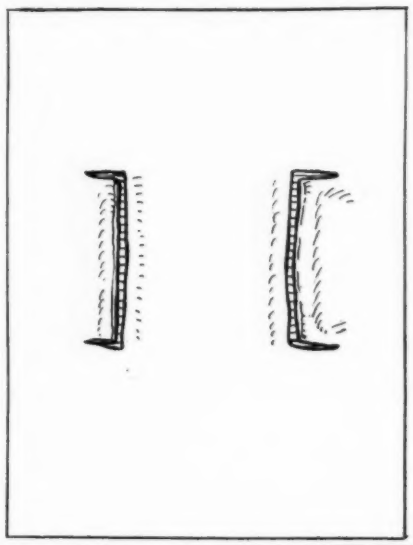

Fig. 12.

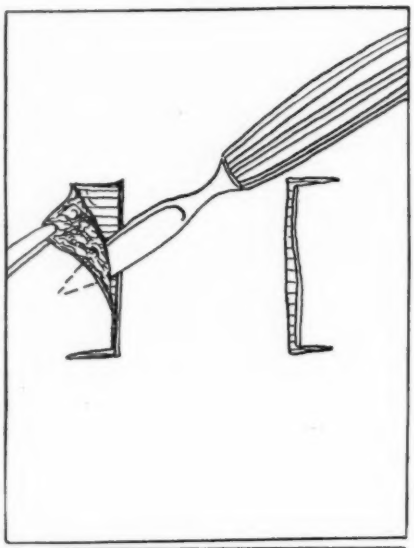

Fig. 13.

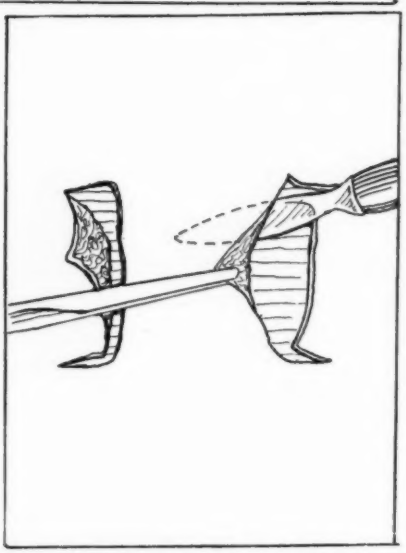

Fig. 14.

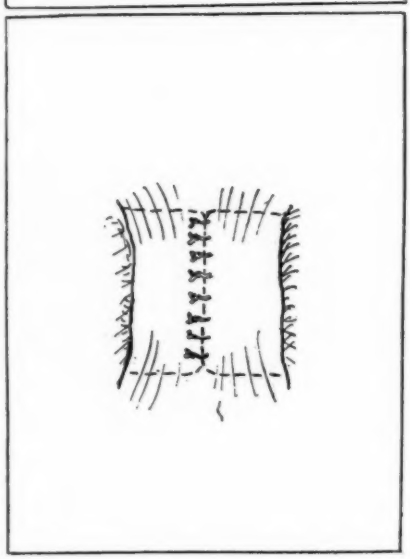

Fig. 15.

Fig. 12. Primary incisions for flat flap graft.
Fig. 13. Undermining lateral flaps.
Fig. 14. Undermining cuff.
Fig. 15. Cuff completed. Dotted lines indicate lateral flaps sutured under cuff.

in the perineum should be treated with the legs wide apart. It may be necessary, especially in children, to place the part in splints.

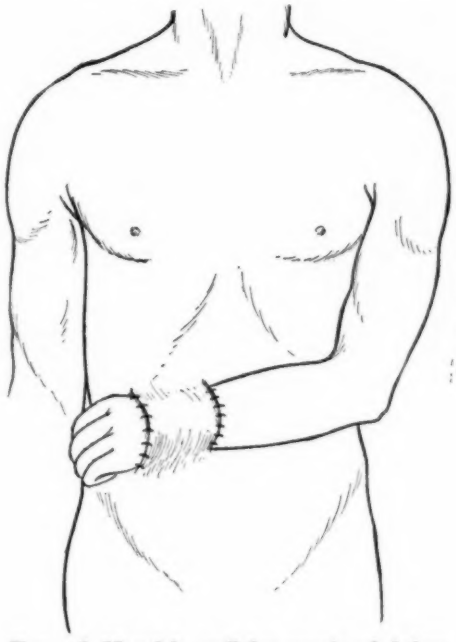

Fig. 16. Hand in cuff for repair of defect on dorsum of hand or wrist.

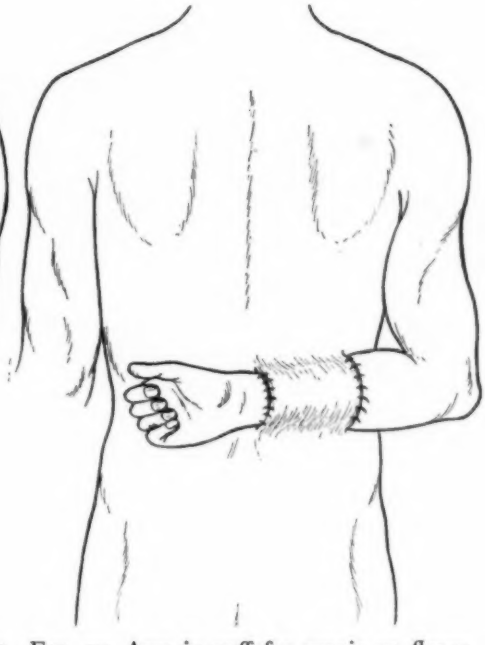

Fig. 17. Arm in cuff for repair on flexor surface of forearm.

CONCLUSIONS

1. Tannic acid treatment of burns is favored.

2. Facial gymnastics in the treatment of facial burns is essential to a good end result.

3. Early skin grafting is strongly advocated; the type of graft depending upon the area to be covered and the site.

4. A plea is made for the prevention of contractures following burns.

REFERENCES

1. Robertson, B., and Boyd, G. *Am. J. Dis. Children*, 25: 163, 1923.
2. Osterberg, A. E. *Proc. Staff Meet. Mayo Clin.*, 8: 121 (Feb. 22) 1933.
3. Weiskotten, H. G. Histo-pathology of superficial burns. *J. A. M. A.*, 72: 259, 1919.
4. Ravdin, I. S. *Atlantic M. J.*, 30: 679 (Aug.) 1927.
5. Reschke, et al. *Arch. f. klin. Chir.*, 146: 763 (July) 1927.
6. McCullough, J. W. *Canadian M. A. J.*, 17: 1176 (Oct.) 1927.

CONTRIBUTION TO THE PHYSIOLOGICAL METHOD OF

REPAIR OF DAMAGED FINGER TENDONS

PRELIMINARY REPORT ON RECONSTRUCTION OF THE DESTROYED TENDON SHEATH

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IN 1880 Nicoladoni performed the first tendon transplantation. Despite the failure of his operation, his was the genius which has inspired the modern development of tendon surgery. In 1910, thirty years later, Biesalski of Berlin conceived the idea of maintaining normal relationship between the transplanted tendon and the sheath of the paralyzed tendon. This he did by pulling the paralyzed tendon out of its sheath and replacing it by an active tendon. Crude though his original technique was, Henze and Mayer working in the Munich clinic of Prof. Lange in 1912 and 1913, were able to prove by animal experimentation that Biesalski's method gave rise to less postoperative adhesions than any technique hitherto published. In 1916 appeared the monograph by Biesalski and Mayer entitled "The Physiological Method of Tendon Transplantation" in which the authors, having worked conjointly for a period of three years, elaborated Biesalski's original idea and perfected the technique of tendon transplantation. Each step of the operation was made to conform to the principles of tendon physiology. The essential function of the tendon is the unimpeded transmission of muscle contraction. To do this the normal relationship between the tendon and its sheath must be retained. Thanks to this work, the technique of tendon operations for numerous paralytic conditions has been developed to such a nicety that a follow-up study of several hundred cases treated at the Hospital for Joint Diseases revealed good or excellent results in over 90 per cent.

In operations for traumatisms to tendons, however, particularly of the fingers, the tale is quite different and much less pleasing. Despite the brilliant contributions of Sterling Bunnell, Sumner Koch, Kanavel, Garlock and others, the percentage of satisfactory results has been so low as to discourage all the prominent insurance companies from recommending tendon plastics in finger injuries. The reason for this marked difference between traumatic and paralytic cases is obvious when one considers the pathology of traumatic cases and the facts of tendon physiology. The trauma creates a scar which completely destroys the tendon sheath, thus making it impossible to establish the essential for tendon function, namely, normal relationship between the tendon and the sheath. When the tendon injury occurs in the palm or above the wrist, where there is no sheath and gliding of the tendon is permitted by the elasticity of the paratenon, good results are not infrequent. In the fingers, however, the proximity of the sheath to the phalanges, the constancy of extensive scar-tissue formation binding the superficial tissues to the bone, and the marked retraction of the tendon ends, all combine to make an almost impossible situation.

The occasional brilliant result achieved by some unusually skillful operator only serves to intensify the pitifully low general average.

Impressed by these facts the authors have for some years been trying to evolve a method of improving the technique of replacing finger tendons after traumatisms. Our thought has been to recreate in some way or other a tendon sheath, so as to reestablish normal gliding conditions. One of us (N. R.) drew attention to the experimental work of Dr. Frederick Prime, Jr. of Columbia University. Prime demonstrated that if a block of chemically pure celloidin were implanted into an animal, it would not produce the typical foreign body reaction (giant cells and leucocytes) but would after a while be found encased in a smooth glistening envelope of tissue, whose flattened surface cells resembled those of the serous cavities. Could not this experimental fact, we argued, be utilized for the creation of a new tendon sheath when the old one had been destroyed?

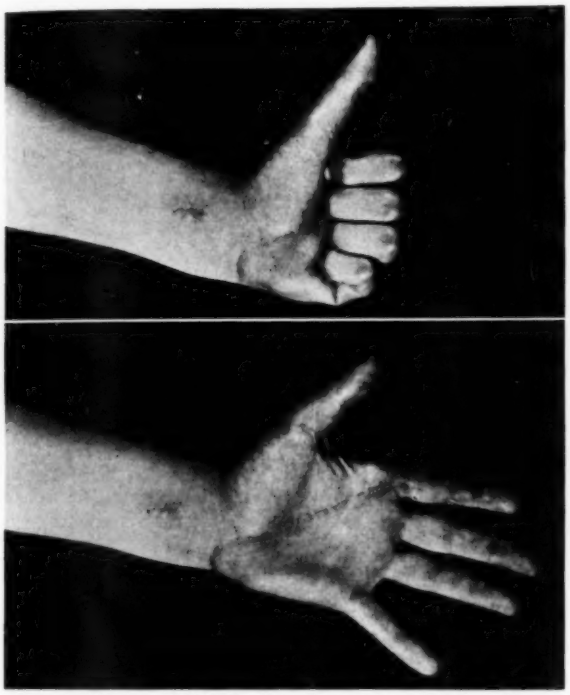

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Figs. 1–4. Views of left hand of patient suffering from complete division of flexor tendons of index finger. First operation six months after injury consisted of excision of scarred tendons and sheath and implantation of 3½ inch celloidin tube. Second operation six weeks later consisted of removal of celloidin tube and implantation of a free tendon graft taken from sublimis tendon of index finger at point above line of division. Note range of active motion of index finger which subsequent to operation is approximately 90 per cent of normal.

After more than two years of constant experimentation in the laboratory and in the clinic, we now believe that we have surmounted the chief obstacles. This report must be considered simply a preliminary, since only a very few cases have been operated on and many problems remain unsolved. Still even the present technique, imperfect though it is, has raised the percentage of results so markedly as to warrant publication.

METHOD

Briefly, the method is as follows: Pure celloidin tubes varying in size and length to correspond with the varying sizes of the digital tendon sheaths, are prepared in advance and sterilized at the outset of the operation by immersion for twenty minutes in oxycyanate of mercury 1:2000. They are then placed in sterile saline solution until ready for implantation. The operation is done in two stages: the first consists in the complete excision of the scar and the implantation of the

celloidin tube; the second, performed after a lapse of four to six weeks, in the removal of the tube and the implantation of the new tendon. In all but one of the cases both in experimental animals and in our patients, the celloidin tube healed in aseptically and at the second operation was found enveloped by a smooth glistening tissue whose surface microscopically as well as macroscopically closely resembled that of a normal sheath. Through this smooth-walled channel the grafted tendon could be seen gliding as the patient contracted his muscle much as the normal tendon glides through the digital theca. The normal relationship between tendon and sheath had been restored.

Details of the method of preparing the celloidin tubes and of the steps of the operation will be published in a subsequent report. The present technique has enabled us to immobilize the operated finger for ten to fourteen days without creating vicious adhesions between the tendon and the new sheath. During this period, the grafted tendon has united to the host with sufficient firmness to permit active exercises and electrical stimulation.

SUMMARY

1. The historical development of tendon transplantation is briefly sketched.

2. Traumatic and paralytic cases differ in that in the former the tendon sheath is destroyed.

3. A method is described for creating a new tendon sheath by the use of celloidin.

4. At a second operation the tendon may be transplanted into the newly formed sheath.

Our thanks are due to the Dupont Company for furnishing us with the supply of chemically pure celloidin and for the cooperation of their staff, also to Miss Geraldine Kahn, whose aid in making the celloidin tubes was invaluable.

REFERENCES*

Biesalski and Mayer. Die Physiologische Sehnenverpflanzung. P. 319.

Bunnell. *Surg., Gynec. Obst.*, 26: 103, 1918. *J. Bone & Joint Surg.*, 10: 1 (Jan.) 1928.

Garlock. *Ann. Surg.*, 1926.

Koch. *Surg. Gynec. Obst.*, 48: 416, 1929; 52: 594, 1931; 56: 1, 1933.

Mayer. *Surg. Gynec. Obst.*, 22: 182–197; 298–306; 472–481, 1916.

Nicoladoni. Die Physiologische Schnenverpflanzung. P. 322.

Prime. Possibilities of preserving the integrity of potential body cavities by the use of a foreign body to prevent adhesion. *Surg. Gynec. Obst.*, 17: 617–625 (Nov.) 1913.

* For complete bibliography, see: Mayer: *Surg. Gynec. Obst.*, p. 298 (March) 1916;
Koch and Mason: *Surg. Gynec. Obst.*, 56: 1 (Jan.) 1933.

AN INTRADERMAL TEST FOR PREGNANCY

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THE experimental work of Zondek-Aschheim[1] and Friedman,[2] in the physiological field led to the development of tests for the determination of pregnancy.

So much has been written and discussed in the literature concerning these tests that repetition is unnecessary. However, they are of great interest, not only from a physiological standpoint but also from their practical utilization.

The writer feels justified in introducing a new test for the determination of pregnancy which is based upon a new principle and has the advantage of simplicity of performance plus quick results obtained by its interpretation. The importance of this is easily seen in cases where a differential diagnosis of ectopic pregnancy and other conditions is desired.

This test is based on previous work,[3,4,5] concerning the nature of homologous proteins producing an allergic reaction by the formation of pseudopodia when injected intradermally in positive cases of malignancy. The same principle has been applied in the determination of pregnancy, utilizing placental tissue as an antigen, which, when introduced intradermally, causes pseudopod formation to take place at the site of injection, in pregnant females, but no pseudopods appear when no pregnancy exists.

That this reaction is purely the result of the homologous nature of the protein is clearly shown by the following experiment: —Isolated young female rabbits were injected with the antigen following the technique of the Friedman test. Corpora hemorrhagica appeared in the ovaries of the rabbits forty-eight hours after the first injection. The same antigen was then heated to 75°c. for thirty minutes and injected into another set of rabbits. No corpora hemorrhagica formed in the ovaries even after successive injections, while the same heated antigen was still capable of producing pseudopodia when used as a test on pregnant women.

There can be only one conclusion, that the hormone carried by the placenta may be destroyed by heating and plays no part in this reaction and that it is purely due to the allergic response on the part of the individual to an homologous protein.

TABLE I

ANTIGEN NOT HEATED	RABBIT	DATE INJECTED	RESULT
#34113	#112	11/20/34—5 cc. 11/21/34—5 cc. 11/22/34	Lap. showed Grade III positive Friedman.
#34816	#111	11/20/34—5 cc. 11/21/34—5 cc. 11/22/34	Lap. showed Grade II positive Friedman.

TABLE II

HEATED ANTIGEN AT 75°C. ½ HR.	RABBIT	DATE INJECTED	RESULTS
#34113	#113	11/27/34—5 cc. 11/28/34—5 cc. 11/29/34	Lap. showed negative Friedman.
#34816	#114	11/27/34—5 cc. 11/28/34—5 cc. 11/29/34	Lap. showed negative Friedman.

This reaction too, like the Zondek-Aschheim and Friedman tests, gives positive results in teratomas, evidently on account of the fetal character of this type of tumor, reacting homologously to the fetal tissue of the placenta.

Method of performing the test: One-tenth of a cubic centimeter of the antigen is injected intradermally with a 27 gauge needle

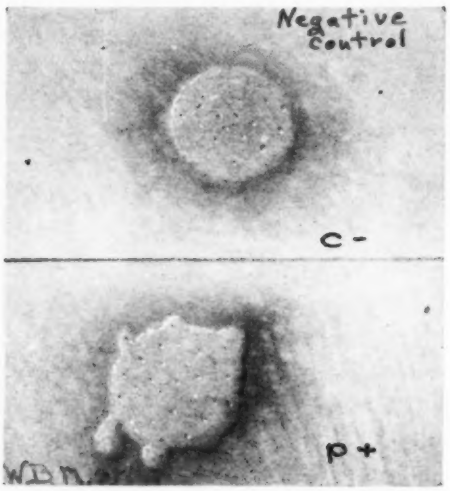

FIG. 1.

and a 1 c.c. tuberculin syringe. Care must be taken that the injection should not be forced, so that no false pseudopods will be formed. In positive cases, a slight area of inflammation with pseudopod formation appears within ten minutes. In negative cases, no such reaction takes place. It is advisable to use a control of physiologic salt solution with each test. The control must always be negative, showing no inflammation and no pseudopods. The bleb after the injection must be perfectly round and have the appearance of orange peel due to the hair follicles, in which case one is sure that the test was done INTRADERMALLY.

Preparation of the antigen: Placentas are obtained as soon as possible following delivery, thereby avoiding any change in the protein which might take place by disintegration. The placentas are carefully washed and cleaned, and freed as much as possible from traces of blood. It is then ground into pulp and placed into acetone, three times its volume, for twenty-four hours. The acetone is then poured off, the tissue allowed to dry and the acetone evaporated. It is then extracted with a decinormal sodium hydroxide solution for twenty-four hours and neutralized with a solution of hydrochloric acid plus a buffer, made up in the following manner: Buffer Solution—0.05 Normal HCl. 2.27 grams KH_2PO_4 per liter. The antigen is brought to pH of 6.9, to which six drops of a mixture, of two parts glycerine to one of tricresol, for every 10 c.c. of the extract is added as a preservative. It is then placed in pyrex containers, as we found that ordinary glass gives up alkalies and changes the pH. The antigen is now ready for use.

Results: In a series of 200 cases* the following results were found:—

TABLE III

NUMBER OF CASES	RESULT OF GRUSKIN INTRADERMAL PREGNANCY TEST	FINAL DIAGNOSIS
10	Negative.	Young woman used as control.
10	Negative.	Young man used as control.
105	Positive.	Full term pregnancy delivered.
8	Negative.	Not pregnant clinically.
12	Positive.	Incomplete abortion.
15	Positive.	Complete abortion.
3	Positive.	Therapeutic abortion.
1	Positive.	Criminal abortion (self-induced).
4	Positive.	Threatened abortion, discharged improved.
10	Positive.	Clinically pregnant.
3	Positive.	Ectopic, tubal, pregnancies.
1	Positive.	Abdominal pregnancy.
4	Positive.	Premature infant delivered.
1	Positive. (Friedman test positive.)	Hydatidiform mole.
1	Positive.	Patient died in diabetic coma, 3 mos. fetus found in the uterus at autopsy.
1	Positive.	Delivered a dead fetus, about 5½ mos.
1	Positive.	2 weeks pregnancy, curettage done, villi found.
2	Negative.	Cervical erosion.
1	Negative.	Ca. of cervix uteri.
1	Positive.	Carcinoma of fundus with metastasis.
1	Positive.	Operated upon, dense pelvic adhesions. No pathologic exam. made.
1	Positive. (Positive test for Ca.)	Clinically questionable pregnancy, believed to be Ca. of Fundus.
48	Positive.	Lost patients, never came back to clinic or delivered at this hospital as far as our records show.
11	Negative.	Lost patients, never came back to clinic or delivered at this hospital as far as our records show.
4	Positive.	Diagnosis, teratoma, as reported by Dr. Emanuel Schwartz[6] and in our own hands.

* Under the clinical supervision of Dr. J. O. Arnold, Professor and Head of the Department of Obstetrics at Temple University Hospital and his staff.

Contraindications: 1. This test should not be done during the menstruation on account of the decidual involvement of that process which will respond to the homologous protein of the placental extract, giving positive reactions.

2. Endocrine disturbances or hypersensitive skins which might respond to anything, even to saline, as has been found. Although uncommon, it must be kept in mind so as to avoid performing the test upon such an individual, as false positives may occur. Therefore it is advisable to use the saline control first, and if this should show pseudopod formation, the patient's skin is not suitable for the test.

SUMMARY

1. An intradermal test for the determination of pregnancy, based upon a new principle, has been introduced.

2. The ease of performance and quick reading of its results proves its value.

3. Its importance in cases where a quick diagnosis is desired, as the differentiation between ectopic pregnancy and other conditions.

4. The large series of correct results in positive and negative cases proves its reliability.

Appreciation is here by expressed for the cooperation and clinical advice of Dr. J. O. Arnold, Professor and Head of the Department of Obstetrics at Temple University Hospital, and his staff in accomplishing this work.

REFERENCES

1. Zondek, B. and Aschheim, S.: Die Schwangerschaftsdiagnose aus dem Harn durch Nachweis des Hypophysenvorderlappenhormons. *Klin. Wchnschr.* 7: 401, 1928.
2. Friedman, M. H.: Mechanism of ovulation in the rabbit; ovulation produced by the injection of urine from pregnant women. *Am. J. Physiol.*, 90: 617, 1929.
3. Gruskin, B. A serum test for the diagnosis of cancer based on a new theory of etiology. *Am. J. Med. Sc.*, vol. 177: 476, 1929.
4. Gruskin, B. Intradermal test for the determination of malignancy. *J. Lab. and Cl. Med.*, 17: 1237, 1932.
5. Gruskin, B. Allergic phenomena in malignancy. *Penna. Med. J.*, 62: 573, 1933.
6. Schwartz, Emanuel. Personal communication.

REFERENCES OF DR. JORDAN*

11. Hinton, J. W., and Church, R. E. The incidence of gastrojejunal ulcer following gastroenterostomy. *Surg. Gynec. Obst.*, 60: 65–73 (Jan.) 1935.
12. Ivy, A. C., Richter, O., Meyer, A. F., and Greengard, H. The relation of gastrectomy to anemia. *Am. J. Dig. Dis. & Nutrit.*, 1: 116 (Apr.) 1934.
13. Judd, E. S. Jejunal ulcer. *Surg., Gynec. Obst.*, 33: 120 (Aug.) 1921.
14. Klein, E., Aschner, P. W., and Crohn, B. B. The end-results of partial gastrectomy for primary gastric and duodenal ulcers. *Tr. Am. Gastro-Enterol. Assn.*, pp. 197–205, 1933.
15. Lahey, F. H. Experiences with gastrojejunal ulcer and gastrojejunocolic fistulae. Presented at the annual meeting of the American Gastroenterological Association, Atlantic City, June 11, 1935.
16. Lapp and Diebald. Quoted by Eusterman, G. B. Discussion to papers on Physiologic studies subsequent to gastric resection for ulcer. *Proc. Staff Meet. Mayo Clin.*, 9: 507 (Aug. 22) 1934.
17. Lewisohn, R. The frequency of gastrojejunal ulcers. *Surg. Gynec. Obst.*, p. 70 (Jan.) 1925.
18. Osterberg, A. E., and Vanzant, F. R. Determination of pepsin in the gastric content and its clinical significance in duodenal ulcer and pseudo-ulcer. *Proc. Staff Meet. Mayo Clin.*, 7: 268, 1932.
19. Paterson, H. J. Jejunal and gastrojejunal ulceration following gastrojejunostomy. *Proc. Roy. Soc. Med.*, p. 238 (June) 1909.
20. Verbrugge, J. Gastrojejunocolic fistulas. *Arch. Surg.*, 11: 790, 1925.
21. Von Redwitz, E., and Fuss, H. Quoted by Alvarez, W. C. Light from the laboratory and the clinic on the cause of peptic ulcer. Am. J. Surg., 18: 207 (Nov.) 1932.
22. Walton, A. J. Gastrojejunal ulceration. *Brit. J. Surg.*, 22: 33 (July) 1934.
23. Weir, J. F. Phenomena including recurrent ulcer following resection of benign lesions. Am. J. Surg., 7: 505 (Oct.) 1929.
24. Wright, G. Discussion on the remote results of the surgical treatment of gastric and duodenal ulcers. *Proc. Roy. Sec. Med.*, p. 153 (May) 1920.
25. Wright, G. Collective inquiry by the Fellows of the Association of Surgeons into gastrojejunal ulceration. *Brit. J. Surg.*, 22: 433, 1935.

*Continued from p. 86.

HEAD INJURIES

CONSERVATIVE TREATMENT WITH LOW MORTALITY*

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INFORMATION is at hand today which should lead to a reasonably clear understanding of the problems presented by cases of head injuries. Views conflict, however, as to the relative efficiency of various methods currently in use for solving these problems. Only by establishing certain proved modes of treatment and discarding the condemned ones can the care of these cases become highly standardized and the results be improved. To clarify our views on these problems experimental work has been of great value in revealing the physiology of the cerebrospinal system, and in pointing out the means of correcting physiological processes disturbed by trauma. Clinical observations supplement this work so well that we are gradually becoming equipped to treat head injuries in a manner approaching an established standard and with results approximating a minimal mortality.

There is much interesting literature dealing with the problems of head injuries. Were the treatment of these cases thoroughly standardized and established, this contribution would serve no purpose. However, even recent comments by well-recognized authorities are not wholly in accord as to the wisdom of certain therapeutic methods. Apparently such controversies can only be settled by convincing clinical observations and much weight is needed to swing the balance decisively.

DISCUSSION

This review of standard conservative methods in 50 recent cases of head injury is offered for its bearing on certain disputed points. In a recent paper on this subject Johnson[1] cites the methods of treatment most in dispute today as dehydration by intravenous solutions, decompression by lumbar drainage, sedation with morphine, and operation with especial reference to the indications for it. In this series it is significant that the intravenous use of hypertonic solutions was uniformly avoided, and it is urged that this practice be abandoned as ineffective and possibly harmful. Repeated lumbar puncture and drainage for the relief of intracranial tension was routinely practiced whenever indicated and was felt to be of inestimable value, and not the dangerous procedure that it is thought to be by such British writers as Riddoch[2] and Jefferson,[3] as well as by Dandy[4] and many others in this country. While morphine was not entirely rejected as a sedative for these cases, certain other drugs were found to be satisfactory substitutes. Although the operative material in this series is almost negligible, as such, the conviction is felt that surgery would have been commoner had a conservative attitude not been maintained in interpreting indications for operation and in relying on non-operative means.

HYPERTONIC SOLUTIONS

In 1933 Jackson[5] and others reported their observations with the use of hypertonic solutions of dextrose given intravenously for the relief of intracranial tension. In 20 cases of severe head injury, he studied the effect of this treatment manometrically and concluded that there was no appreciable lowering of the cerebrospinal pressure,

* From the Surgical Service of Dr. Paul B. Jenkins, Binghamton City Hospital, Binghamton, N. Y.

but that in many cases there followed rather an elevation. He considered the use of such solutions dangerous in leading to a false sense of security, which might allow prolonged pressure on the cortex of the brain with irreparable damage to the nerve cells. In his paper attention is drawn to significant contributions in this field beginning with the original observation of Weed and McKibben[6] that hypertonic salt solution given intravenously was found to lower intracranial pressure in laboratory animals. From this point reference is made to the later work of Hoff,[7] who showed that after a preliminary fall in intracranial pressure the brain cells took up the salt and experienced a swelling greater than before. Then he recalls the work of Ernst,[8] who found that in animals, previously subjected to head trauma, an immediate prolonged rise in intracranial pressure followed such intravenous injections of hypertonic salt solution. The conclusion that salt solutions apparently were toxic to brain cells was substantiated in clinical trials of this method where such treatment often resulted in convulsions, coma and even death. Thus, the use of salt was abandoned but hypertonic dextrose solutions have since been in vogue. Jackson's studies, however, would indicate the ineffectiveness of this method of treatment. In one-half of his cases a reduction of 10 to 50 mm. H_2O pressure was obtained within thirty minutes, followed thereafter within two hours by a rise above the original pressure, often 50 per cent higher, which persisted for twenty-four hours. In the other half of this series a rise in pressure was immediate and did not subside for twenty-four hours. Furthermore, a rise in blood pressure and labored respirations were observed in half the cases so treated.

Since his observations were published, a report has been made by Massermann[9] regarding the influence on cerebrospinal fluid pressure of the intravenous injection of varying amounts and concentrations of dextrose solutions in normal human controls. A study of these results shows that substantial reductions in cerebrospinal pressure were not obtained when using amounts and concentrations of dextrose commonly in use clinically; furthermore, the reductions which might be called at all substantial, from a clinical point of view (the greatest was from 60–70 mm. H_2O) were observed only after using amounts and concentrations of the solution which caused such symptoms of toxicity as severe headache and pyrexia. Such solutions are never used for therapeutic purposes.

The interpolation of this more recent material into Jackson's resumé of the subject seems to enhance the importance of his own clinical studies which had already led him to the conclusion that the intravenous use of hypertonic solutions is ineffective and dangerous in cases of severe head trauma and should be abandoned. Jackson explains the clinical failure of this method as due to primary circulatory stasis from pressure on veins and venous sinuses by a swollen congested brain and excess fluid and blood in the ventricles and cisterns. In the presence of these conditions the injected fluid has no opportunity to accomplish its purpose, although in normal animals without obstructed circulation, a primary fall in pressure is obtained. In the present series of cases, this method was uniformly avoided. The results seem so satisfactory and the mortality so nearly minimal in the absence of such treatment that these observations are offered as further argument for the deletion of intravenous hypertonic fluids from the ideal standardized treatment of head injuries. There are still many writers who favor the use of this method, among them Horrax[10] and Riddoch and Jefferson. Sharpe[11] feels that dehydration is of temporary value only in less seriously injured patients, particularly when there is very little blood in the cerebrospinal fluid; in the presence of much blood he suggests that dehydration may concentrate it and hasten its coagulation, a condition which he believes leads to serious late sequelae. Johnson does not advise routine use of this agent, but feels

that many cases of increasing pressure will benefit by it. He also finds it useful in combating shock. Munro[12] feels that it may be used as a life-saving measure to combat a high degree of intracranial tension, and may be repeated two or three times. He points out, however, that its effect is temporary.

LUMBAR DRAINAGE

Perhaps the first to establish the value of repeated spinal puncture and drainage as a means of reducing intracranial tension was Jackson.[13,14] It was his observation, as a result of postmortem studies, that edema was never marked in these cases but that excessive fluid and blood commonly distended the ventricles and cisterns. By withdrawing spinal fluid he relieved intracranial tension directly and also indirectly by thus reducing pressure on veins and sinuses with improved circulation, diminished congestion and greater absorption. Clinically, he observed a cessation in stertorous breathing, a relief of bradycardia and other signs of improvement. Johnson also finds this method valuable in the more serious cases. Sharpe uses lumbar drainage freely in serious cases, sometimes repeating it once, twice or three times in twenty-four hours. With this valuable therapeutic agent he says he has decreased his operative cases from 31 to 26 per cent. He feels there is no reason to expect harmful results from this method if manometric readings are carried out and pressure is reduced only 50 per cent at one treatment.

Patel and Leclerc[15] recently reported the use of this method in 28 cases with good results; they feel that it is a dependable method to lower intracranial tension, combat edema, and remove blood from the subarachnoid spaces. In his appraisal of this method, Munro finds it very valuable first in removing excess fluid and blood mechanically, and subsequently in reducing circulatory congestion and in allowing the damaged brain cells to recover. He feels that in lumbar puncture we have the only method of relieving what he terms a "mechanical hydrocephalus" which complicates the more serious cases that are characterized by the presence of free blood in the subarachnoid spaces. He points out that the blood cells, by their presence, plug the arachnoidal villi, preventing absorption of fluid. In two contrasting series of cases, one treated with lumbar puncture and the other treated without it, he observed that the mortality decreased 50 per cent with the use of this method.

In the present series, repeated lumbar punctures with manometric readings and drainage were practiced whenever indicated either by previous high pressure readings, or by complaints of headache and dizziness in the conscious patients and by such clinical signs as restlessness, and pulse or respiratory disturbances in the unconscious ones. No harmful effects were observed from this procedure.

In spite of such evidence, Dandy warns against lumbar puncture as a dangerous practice, pointing to the possibility of a herniation of the brain stem. He feels that this method is of little value anyway, stating: "No patient has ever been saved by it, and many have been lost who otherwise might have survived." Jefferson likewise feels that it is a dangerous procedure, particularly when it is not controlled by manometric readings. Riddoch believes that lumbar puncture should be limited to the removal of free blood, feeling that increased pressure is best treated by dehydration.

MORPHINE

Comparatively little controversy exists over the use of morphine as a sedative in these cases. While Johnson says that this drug is held objectionable by many for its effect in masking the true clinical condition, as in abdominal surgery, this belief does not appear to be general. The greatest concern seems to lie in the power of morphine to depress the respiratory center, often previously embarrassed by intracranial pressure and hemorrhage. Munro condemns its use for this reason;

Riddoch likewise is opposed to it and suggests that chloral, bromides and other substitutes be used. Russell[16] is more compromising and recommends its free use in the absence of compression by hemorrhage or depressed fracture. In the present series a strongly depressive effect on respiration was observed only once.

OPERATION

In step with the recent popularity of lumbar drainage has been the trend toward conservatism in operative intervention with head injuries. Munro feels that the best results can only be obtained by limiting surgery to cases definitely diagnosed extradural hemorrhage or subdural hematoma, with the exception, of course, of compound fractures and certain types of depressed fractures. He is opposed to routine decompression in serious cases and criticizes Dandy's figures that 30 per cent of serious head injuries are fatal unless surgical decompression is resorted to, whereby the mortality may be reduced to 20 per cent. However, as a last resort in a case not responding to treatment, Munro does advocate lateral trephine openings to allow examination for extradural or subdural hemorrhage. Under similar conditions Johnson also practices this procedure and utilizes the openings to drain excess fluid from the lateral ventricles. Patel and Leclerc feel that operation is indicated in intracranial extravasation and depressed fractures, but that otherwise the wisdom of it is problematical. Riddoch believes decompression should be limited to the practice of relieving compressions due to hemorrhage. Thus the sentiment is found to be rather general though hardly unanimous that indications for operation are few and rather sharply defined.

REVIEW OF CASES

Classification: This series comprises 50 consecutive cases of head injury recently treated on the Traumatic Service of the Binghamton City Hospital. A classification somewhat along the lines suggested by Munro would group 25 cases (50 per cent) as concussions, with or without "congestion and edema"; 8 cases (16 per cent) as contusions; and 17 cases (34 per cent) as lacerations.

In the group of concussion cases are a few patients who failed to give a history of unconsciousness which Munro considers the diagnostic feature of this condition. Some of these cases did, however, show increased spinal fluid pressure and more or less dizziness, drowsiness and apathy, which Munro considers to be signs of "congestion and edema" which sometimes complicate concussion. Riddoch, however, seems a little less dogmatic about a definition of this condition, feeling that concussion may be slight or severe, with dizziness on the one hand or deep unconsciousness on the other. Although a precise definition of the term is difficult, most writers are agreed that concussion is a molecular disturbance as opposed to a microscopical or macroscopical change.

In the contusion group, the general clinical picture of concussion was present in more intensified form, usually with prolonged unconsciousness which was often followed by headache, drowsiness, vomiting and apathy. Often considerable shock was manifest. The diagnostic point in this group of cases, as suggested by Munro and others, was the presence of enough blood in the spinal fluid to color it. This finding is assumed to be caused by punctate hemorrhage from pial vessels.

In the cases of laceration, profound cerebral disturbance often was manifest by shock, loss of sphincter control, great restlessness and delirium, continued high intracranial pressure, and prolonged unconsciousness often for many days following the injury. The differential point here lies in the presence of frank blood in the spinal fluid. In this group of cases a febrile course was common.

In this series no depressed or compound fractures occurred. While *x*-ray films were taken in practically all the serious cases

and in most of the milder ones, the results were not felt to be very conclusive since the exposures were rarely as numerous as Munro suggests, i.e., anteroposterior, posteroanterior and stereoscopic lateral views. However, in the majority of cases of head injury the presence or absence of the simple linear type of fracture seems to be of academic importance only.

In 4 cases (8 per cent) bleeding from the ears was observed and in one such case a unilateral facial paralysis developed a few days after the injury, but was not permanent. Eleven cases (22 per cent) showed bladder incontinence or retention requiring the use of a catheter. True bradycardia, probably indicating bulbar pressure, was rarely observed but in one patient who recovered this condition was marked, with a pulse which remained at 38 or 40 for many hours. Other signs of more serious neurological disturbance such as abnormal reflexes, inequality of pupils, aphasia, convulsions and Cheyne-Stokes breathing were noted in various patients who subsequently recovered. The highest temperature recorded among the uncomplicated cases of head injury was 104°F.

Operation: Two patients (4 per cent) came to operation, one for extradural hemorrhage and the other for subdural hematoma. The former case resulted fatally and will be considered further under mortalities. The latter case presents a few interesting features deserving mention:

On admission to the hospital this patient showed a Cheyne-Stokes type of breathing with alternate hyperpnea and apnea. He was flaccid. Though not unconscious, he seemed stuporous. The right pupil was dilated and the left contracted. After about ten minutes of forced ventilation with carbon dioxide and oxygen the respirations became normal and the pupils became equal. There was some mental improvement subsequently at which time the right optic disc seemed a little congested on ophthalmoscopic examination. Gradually stupor returned and, twenty-four hours after admission, unconsciousness supervened and left-sided clonic convulsions began with conjugate deviation of the eyes and rotation of the head toward that side. Operation revealed a subdural hematoma over the right cortical motor area.

Mortality: Dandy gives a mortality for head injuries ranging from 20 to 30 per cent. Munro, however, feels that "in the present state of our knowledge the proper use of therapeutic dehydration and lumbar puncture decompression applied in accordance with the diagnosis, based upon a proper conception of the pathology of brain injury, should permit only about 10 per cent of patients suffering from the ordinary forms of brain and skull injury to die; and if all possible forms of skull and brain injury are included the mortality should not be over 16 per cent." In this series there were 4 deaths from all types of head injuries or a mortality of 8 per cent; one from pneumococcus meningitis four days after admission, one from shock eighteen hours after admission, one from shock and hemorrhage caused by multiple penetrating bullet wounds two hours after admission, and one subsequent to operation for extradural hemorrhage.

In the operative case, some undetermined interval elapsed between the injury and hospitalization. On admission the patient was deeply comatose, showing signs of unilateral compression. Although his condition seemed poor, the blood pressure reading was found to be 130/80. Under ether anesthesia an extradural clot was removed and hemorrhage was stopped with relief of neurological signs, but coma continued and death followed thirty-six hours later. Post-mortem examination revealed a small amount of blood in the cisterna magna apparently from pial vessels. The cause of death appeared to be traumatic and surgical shock. This patient might be considered a subnormal risk however, since he was a chronic alcoholic and was also addicted to the use of morphine.

Munro feels that any of his patients with head injury who die after the first thirty-six hours of hospitalization are the victims of inadequate treatment due to faulty diagnosis. While such an assumption seems rather rigorous, the general

acceptance of this attitude by surgeons handling these cases would surely stimulate a closer surveillance of the patient and greater care in diagnosis as well as precision in treatment. In justification of the modern conservative trend in treatment, which was followed in this series of cases, it should be noted that all of our fatalities occurred during the first thirty-six hours of hospitalization with the exception of one, in which the patient died on the fourth day from meningitis, a complication which cannot be avoided in these injuries.

Treatment: At the risk of repetition a few words might be written here regarding some observations on therapy in these cases. No effort was made to lower intracranial pressure by the administration of hypertonic solutions intravenously. Magnesium sulphate was used rather freely both orally and rectally when possible. Repeated lumbar punctures with manometric readings were performed for diagnosis and for relief of intracranial tension wheneves indicated. Usually the fluid was allowed to escape until a normal pressure reading war obtained. In this series the greatest number of these procedures in one patient was a total of ten punctures over a period of two weeks, seven of which were done during the first seven days. The highest reading of intracranial tension was a pressure of 650 mm. H_2O.

While the use of morphine was not always avoided, many other hypnotics were tried in restless uncooperative and semiconscious patients for the relief of these symptoms and also to accomplish sedation preliminary to lumbar puncture. Paraldehyde in 1 or 2 c.c. doses intravenously was found to take effect immediately, and while rather transitory it sufficed very well for a short procedure. Phenobarbital sodium hypodermically and intravenously in 1½ to 3 gr. doses was found to be rather a dependable agent. When administered every three to four hours it proved to be a reasonably satisfactory sedative in cases of extreme restlessness especially in those patients requiring restraint. When oral or rectal medication was possible pentobarbital sodium proved to be an effective drug.

Restriction of fluid intake and careful supervision of water balance is urged by some writers as a preventive of cerebral edema and increased intracranial tension. Johnson, for example, limits the fluid intake to 20 ounces every twenty-four hours until the danger of intracranial complications is over. In this series of cases such fluid restriction was not practiced; in fact in many of the cases where unconsciousness persisted for several days normal salt solution was given subcutaneously in litre quantities when a dry tongue indicated dehydration, without apparent harm. The intravenous administration of fluids was avoided however since, as Massermann points out, even isotonic fluids given in this way elevate cerebrospinal fluid pressure to a degree proportionate to the amount of the fluid and the speed of its administration.

Dandy[17] has reported favorably on the use of avertin in intracranial surgery, pointing out that it does not elevate blood pressure and intracranial tension as most anesthetics do. The popularity of this agent seems well established. While the lone operative mortality in this series could scarcely be attributed to ether anesthesia, it seems probable that this preparation added measurably to a burden already heavy. In the successful operative case the selection of avertin as a basal anesthetic was felt to have been a fortunate one. The conviction cannot be escaped that no therapeutic measure should be spared in these desperate cases if there is reason to expect even the slightest benefits from it. Thus the oxygen tent was used to give temporary support to an overtaxed circulation in an apparently hopeless case and it was thought to be directly responsible for a life which probably would have been lost without it.

CONCLUSIONS

1. Literature is reviewed to show that the present trend in the treatment of head injuries is toward standardization along conservative lines.

[Concluded on p. 91.]

CRANIOCELE

WITH REPORT OF TWO CASES REPAIRED BY BONE GRAFT*

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CRANIOCELES may be defined as protrusions of the cranial contents through defects in the skull. They may consist of cerebral membranes containing fluid (craniomeningoceles) or may contain both membranes and a portion of the brain itself (encephaloceles, encephalocystoceles). This paper has to deal with those of congenital origin rather than those following or due to trauma. The encephalocele is often called a hernia of the brain but should not be confused with multiple small hernias in which the brain-substance protrudes only through the dura mater. These latter have an entirely different etiology and give rise to an entirely different clinical syndrome.

Congenital cranioceles occur through bony defects in the cranium (cranium bifidum). This is usually due to the lack of fusion of one of the cranial bones with its fellow of the opposite side in the midline. Thus most cranioceles are found in the occipital region posteriorly or in the region at the base of the nose anteriorly. The former region is thought to be a somewhat more common site. However, Sievers reported 27 of 41 cases of this condition in the nasal-orbital region. They have also been found in the temporal and parietal regions away from the midline and rarely in the posterior pharynx.

The condition is quite rare, no case having been observed by Birch and Hirschfeld in 200,000 patients of an ophthalmological clinic. In 1929 Cordes collected about 1000 cases in the literature. Since his review only 43 cases have been reported, references to which are subjoined. These reports appeared in the German, Spanish, French, English, Italian, Japanese and Polish literature, about one-third of the total being in German.

These congenital malformations may vary in size from that of a walnut to larger than the head itself and are covered by skin which is usually thin and may become ulcerated. In most cases they are present at birth and gradually increase in size. The symptoms and signs vary markedly with the location of the tumor mass and also with its contents.

Two cases are being reported illustrating cranioceles located in the occipital region, and a method of repairing them.

CASE 1. J. B. (15048), a white boy of six who was in the first grade at school, was admitted complaining of a large soft mass on the occipital region of the cranium. The mass had been present since birth and was gradually increasing in size. He had experienced epileptiform seizures involving the left extremities since birth, occurring as often as six times a day; the longest period he had been free of seizures had been one month. His attacks consisted of loss of consciousness, cyanosis, and spasticity of the left extremities. There was also a history of major convulsions lasting six to nine hours in which he had incontinence. Examination revealed a soft tumor mass located in the midline over the occiput and measuring $5 \times 5 \times 4$ cm. The patient was indifferent to examination and gave unreliable answers to questions. He was of subnormal intelligence and cooperated poorly. Beneath the tumor mass was a cranial defect about 5×5 cm. The remainder of the physical examination, including a neurological examination, was normal. *X*-rays revealed a

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sharply outlined oval defect in the occipital bone in the midline measuring 4 × 7 cm. (Fig. 1C). There was also an absence of 1.5 cm. of the undersurface of the cranium. A piece of bone for a transplant 3 × 5 cm. was removed from the ilium consisting of the external table and

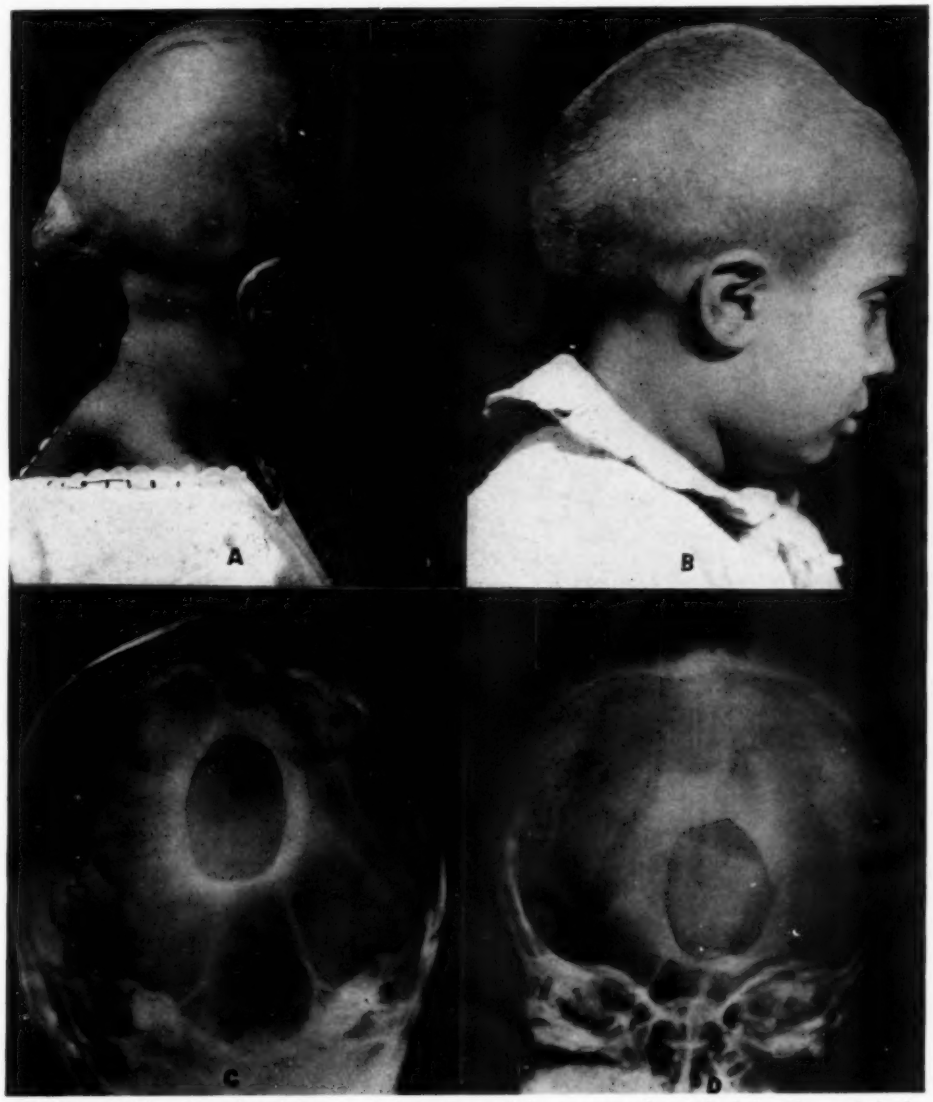

Fig. 1. Case 1. J. B. A. Side view showing protrusion of cranial contents through defect in occipital region. B. Side view after operation, mass being entirely reduced. C. *X*-ray of occipital region of skull showing an oval-shaped defect just above foramen magnum in midline. D. *X*-ray showing bone graft somewhat faintly visualized and filling about three-fourths of congenital defect.

arch of the first cervical vertebra at the midline posteriorly. There was questionable incomplete fusion of the laminae of lumbar five and upper sacral segments.

Repair of the meningocele was done by Dr. Percival Bailey as follows: A transverse incision was made across the meningocele and the skin carefully dissected back everywhere until the margin of the bone was exposed. The margin of the bone was freshened with a rongeur. The dura was separated from the most of the cancellous portion. A lumbar puncture was done but the fluid dripped out slowly under practically no tension. Pressure on the meningocele did not increase the rate of flow. By maintaining steady pressure, however, the tumor mass was sufficiently reduced so that the bony plate could be firmly wedged transversely, practically filling the opening, leaving only a narrow margin posteriorly which was not covered by bone. Since the posterior edge of the defect flared

outward it was broken inward by a rongeur and the fragments left in place in the hope that they would fill this defect. The superfluous scalp was removed and the wound closed with subcutaneous catgut and superficial silk. The patient's condition was good throughout the operation. During his convalescence he received 15 c.c. of a concentrated solution of magnesium sulphate and 0.06 gm. luminal daily for six weeks, at which time he was discharged. He was managed with difficulty, needing restraint at times because he removed his dressings several times and on one occasion opened his wound. It healed slowly but never became infected and did not drain cerebrospinal fluid.

The epileptiform attacks occurred less frequently following operation, the patient having about one severe attack and two or three minor attacks a month. There was marked mental retardation. Subsequent *x*-rays of the skull showed little change in the bone grafts. There was some mottling but they remained in position (Fig. 1D).

FIG. 2. Case II. J. C. A. Side view showing protrusion of cranial contents through bony defect in occipital region. B. Side view following osteoplastic repair of bony defect. C. *X*-ray of skull showing a circular defect in occipital bone in midline with lack of fusion of remaining portion of two halves above defect. Also note separation of two parietal bones. D. Same as (C) following osteoplastic repair of bony defect.

CASE II. J. C. (20776), a white female of three years, was admitted because of a defect at the base of the skull which had bulged since birth. Physical examination showed the head to be greatly enlarged with an encephalocele in the occipital region, about the size of a hen's egg. She had an adenoid voice, but no other physical or neurological defects.

She appeared normal mentally. She walked on a wide base but with no staggering. *X*-rays revealed a bony defect in the occipital region of the skull in the midline measuring 3 × 3.5 cm. (Fig. 2C). It was located 4 cm. inferior to the lambda.

The girl was admitted to the hospital for closure of the bony defect. Under ether anesthesia Dr. Bailey freed the margin of the occipital defect and a bone-graft, taken from the left tibia, was inserted in two strips. The meningocele had been in this case easily reduced. The skin was sewed together and invaginated onto the grafts and held in place with a pad of cotton. Some projectile vomiting was observed only on the first postoperative day.

The wound healed by primary intention and the patient was discharged on the tenth day after operation. An *x*-ray revealed the bone grafts in good condition two weeks after operation (Fig. 2D). The patient returned four months later with a pulsating but not protruding area in the lower occipital region. *X*-rays revealed the upper bone transplant to be quite firmly united with the occipital bone and closing that part of the original defect. The lower bone transplant had been almost completely absorbed, only a very thin shell of bone remaining. The lower part of the defect was therefore partly open and pulsated, but a firm fibrous capsule had evidently formed because the area did not bulge. The patient did not keep a return appointment and cannot since be located.

DISCUSSION

In the treatment of this condition various procedures have been carried out. It has been thought by some that preservation of the sac would prevent the formation of acute hydrocephalus. This belief was based upon the assumption that the membranes of the sac would serve as a safety valve by the absorption of spinal fluid. This point has received considerable discussion and at present there is no uniformity of opinion. Many cases of the orbital or naso-orbital variety have been aspirated or excised before a true diagnosis has been arrived at. Not infrequently these patients have died of meningitis before the diagnosis was made. In the occipital region there has been no difficulty of diagnosis. When the tumor mass can be almost completely reduced by aspiration it is easily removed and the wound closed in layers by suturing soft parts over the defect. This has been accomplished successfully in a good many cases. However, when a portion of the brain protrudes through the opening and must be excised to obtain a complete closure, the mortality of the procedure is considerably increased. Definite statistics on the mortality rate of the various types of operations are difficult to obtain and evaluate. Successful bone-graft operations have been reported by Santner, Palmero, Bender, Dandy and others.

Rapidly increasing hydrocephalus is a definite contraindication for operation. The success of the operative treatment of this condition is determined to a considerable degree by the degree of intracranial pressure.

SUMMARY AND CONCLUSIONS

Cranioceles are congenital protrusions of cranial contents through defects in the skull. These are usually due to failure of union of a cranial bone with its fellow of the opposite side in the midline. They occur most commonly in the occipital region in the midline and at the base of the nose. They may vary in size from a few centimeters in diameter to the size of the child's head. Indications for operation are: absence of rapidly increasing hydrocephalus or absence of any great amount of cerebral tissue in the hernia and the possibility of completely reducing the contents. The success of operative treatment is determined to a considerable degree by the degree of intracranial pressure. Two cases of occipital cranioceles successfully treated by osteoplastic repair of the bony defect are reported.

REFERENCES

Akhutin, M. N. Pathogenesis and surgical treatment of frontal encephalocele. *Vestrik. klin.* (Nos. 48–49), 16–17: 142, 1929.

[For Remainder of References see page 82.]

CALCIFIED BREAST TUMORS

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CALCIFIED breast tumors have occurred so infrequently that very little is gained from a study of the literature on the subject. Our interest was recently aroused by a case of circumscribed, calcified cyst of the breast, a lesion which at first was mistaken for carcinoma.

In the earlier literature there are reports of huge calcified breast tumors. Velpeau[1] quotes a report by Berard of a man who is said to have had dyspnea from the weight of the tumor. Morgagni[2] describes a tumor which is supposed to have existed for thirty years during which time pieces of bony tissue like marbles ruptured through an opening. Many of the earlier reports were probably not cases of true breast tumors, but extensions to the breast of tumors of the chest wall. A case of this kind was reported by Riedinger and Henschen (quoted by Deaver[3]) as a chondroma of the ribs invading the mammary region in a man. Many authors have doubted the occurrence of true bony tumors of the breast. Lubarsch and Henke[4] state that no such tumors have been described in humans though they have been reported in dogs and cats. Billroth, in 1889, in a monograph entitled "Die Krankheiten der Brustdrüse" stated that he had never seen anything resembling cartilage in tumors of the human breast and he questioned the existence of osteoid tumors (Dyke[5]). Deaver, however, collected from the literature about two dozen cases of mammary tumors which were said to have contained cartilage or bone.

Descriptions of so-called mixed tumors of the breast are not infrequent in the literature. They are referred to variously as chondromata, chondrosarcomata, chondro-osteosarcomata, etc. In this study of the subject an effort had been made to limit the reported cases of breast lesions to those which showed definite calcification or the presence of true bone. Thirty-one cases of this kind have been studied; they fall into three groups as follows:

1. The teratoid mixed tumors of the breast which have been so adequately described in pathological texts.[6] In these tumors the mesodermal and ectodermal elements differentiate toward the adult type. Rarely found in the human breast, such tumors occur frequently in dogs, as is evident from the reports of Virchow,[7] Cornil and Souligoux[8] and Cushing and Ortschild.[9] Tumors of this group are not often associated with regional adenopathy but they have been considered potentially malignant. The surgical treatment employed in this type of tumor has usually been a radical amputation of the breast with axillary dissection.

2. The calcifying sarcomata or carcinosarcomata. These tumors, often referred to as osteochondromyxosarcomata, constitute a complex and rare type of sarcoma. Occasionally they are associated with a dermoid cyst or adenoma which would suggest a relation to the teratoid growths.

3. The calcified retention cysts of the breast. To this group belongs the case described herein.

CASE REPORT. (A. B. 54468.) This patient was a German housewife, fifty-four years of age, who was admitted to the hospital because of symptoms of partial intestinal obstruction associated with an incarcerated umbilical hernia. Fluoroscopic studies of the large intestine with barium enema showed that the cecum and ascending colon had formed a partial volvulus in the incarcerated hernia. At operation this condition was corrected and the hernia repaired. At the time of the fluoro-

scopic examination, a calcified density was observed in the region of the left breast. The breast, when examined, proved to be pendulous and fatty, but equal in size to the right breast. In the upper outer quadrant, 2 cm. distant from the nipple, a circumscribed, stony-hard mass could be palpated. It was not attached to the skin or underlying muscles but apparently had some relation to the nipple. There was no retraction of the nipple, however, and no dimpling of the skin. There was no axillary adenopathy. On transillumination a dense, circumscribed shadow was outlined in the breast. There was no evidence of invasion of the surrounding breast tissue. No local tenderness existed and the patient had been unaware of the presence of the mass. There had been no discharge from the nipple. *X*-ray studies of the breast were made; the lateral view is shown in Figure 1. The location of the palpable mass corresponded to the lobulated, circumscribed calcified density revealed by the fluoroscope.

Fig. 1. Lateral *x*-ray view of breast showing circumscribed calcified retention cyst.

Fig. 2. Cut section of specimen showing calcified retention cyst of breast in its relation to ducts and nipple.

An elliptical segment of breast tissue including skin, nipple and tumor was excised under local anesthesia. The section of the specimen is shown in Figure 2. The calcified nodule rested 1 cm. beneath the skin and 1.5 cm. from the nipple. The mass was encapsulated. The center of the calcified lesion was soft and contained a grumous substance. The microscopic examination revealed homogenous non-cellular tissue arranged in sheets and whorls which resembled hyalinized connective tissue. This tissue was surrounded by a dense capsule of connective tissue. Dilated ducts containing material of a sebaceous type were found in the neighborhood of the mass. The specimen was described as a retention cyst of the breast which had undergone calcification.

The operative wound healed per primam. *X*-ray studies of the right upper quadrant of the abdomen showed a spherical, calcified mass, evidently a solitary gallstone.

The record of this case is given because of the infrequency of such lesions in the breast and to emphasize the value of modern methods of examination in differentiating calcified tumors and carcinoma of the breast. In the 31 cases found in the literature, there is only one reported which is similar to the one described here. This was a so-called petrified breast reported by Bryk.[10] Bryk, writing in 1880, suggested that the calcification in the breast might be due to faulty elimination of calcium salt in the urine, for death occurred with signs of uremia. The case reported by Fry,[11] a section of which is shown in Figure 3,

resembles the author's case in the gross. The tumor was called an osteoclastoma, because of the presence of a large number of

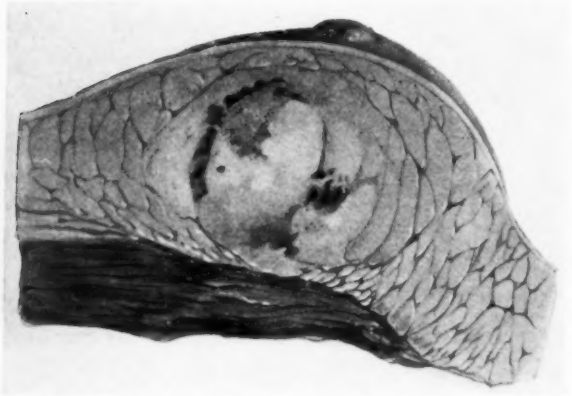

Fig. 3. Cut section (after Fry) of specimen from Fry's case reported as osteoclastoma. Resemblance in gross to calcified retention cyst (Fig. 2) is very striking.

giant cells of the epulis type and because of the similarity in form and function of these cells to those in myeloid sarcoma. Other cases of breast tumor containing bone collected from the literature are classified and listed below. Many of the cases were reported so briefly that their classification was difficult.

Case I. Cooper[14] (1836). Female patient, fourteen years old. "Tumor had appearance of that cartilage which supplies the place of bone in young subjects, the remaining part was ossific"; probably an osteochondroma.

Case II. Amann[15] (1860). "A complex connective tissue new growth of the breast with hard and calcified fibroma"; classified as enchondroma with calcified portions.

Case III. Wagner[16] (1861). Enchondroma, myxoma and bone with carcinoma.

Case IV. Stilling[17] (1875). Female patient, fifty-six years old; duration of tumor six months. Patient died two months after excision of the tumor from "bilateral pleurisy." Calcifying spindle-cell sarcoma.

Case V. Smith[18] (1878). Female patient, sixty-five years old. "A large cystic tumor in connection with scirrhous carcinoma which had undergone calcareous degeneration." Amputation of breast was done. Result not given. Classified as a scirrhous carcinoma with calcification.

Case VI. Stilling[17] (1879). Female patient, fifty-three years old. "A firm, light gray tumor with bone-like deposits." Tumor present one and a half years. Patient died five days after breast amputation of pyopneumothorax. Classified as a calcifying spindle-cell sarcoma.

Case VII. Stilling[17] (1880). Female patient, fifty-nine years old. A reddish gray tumor permeated by many cysts filled with light red fluid. Tumor present ten years. Following breast amputation there was a local recurrence and the patient died four months later. Classified as a calcifying spindle-cell sarcoma.

Case VIII. Billroth[19] (1880). Myxosarcoma with cyst formation and small hard masses formed of bony substance developed out of the connective tissue. Classified as myxosarcoma with bony tissue.

Case IX. Bryk[10] (1880). Female patient, sixty-two years old. "In the middle of the tumor lay a calcium concrement surrounded by connective tissue, surface of the tumor rough, spindle cells present, numerous cavities in the midst of calcified connective tissue." Listed by the author as a calcified breast.

Case X. v. Hacker[20] (1881). "A partly invasive tumor which on section showed adenofibromatous structure, fibrocartilaginous areas, cysts and carcinomatous areas." Classified as an osteochondrofibroma.

Case XI. Herteaux[21] (1881). Female patient, fifty-two years old. Tumor showed scirrhous tissue containing ossified and cartilaginous areas. Classified as osteochondrosarcoma.

Case XII. Durham[22] (1884). Female patient, twenty-seven years old. A hard friable, lobulated, encapsulated tumor with a plate of bony tissue in the center. Classified as sarcoma containing cartilage, bone and adenoid tissue.

Case XIII. Clarke[23] (1886). Female patient, forty-six years old. A bony hard tumor surrounded by softer tissue was removed by simple breast amputation twenty-three years after it was first noted. Classified by the author as a calcifying chondrosarcoma.

Case XIV. Battle[24] (1886). Female patient, seventy-three years old. A vascular tumor with numerous hemorrhages and bony in part. Classified as a calcifying chondrosarcoma.

Case XV. Leser[25] (1888). Female, sixteen years old. Tumor composed of solid hard whitish tissue with calcium deposited in the intercellular substance. Patient reported well two years after operation. Classified as osteochondroma

Case XVI. Pilliet[26] (1890). An intracanalicular fibroma with bone.

Case xvii. Arnold[27] (1897). Female patient, sixty-seven years old. Spindle-cell sarcoma mixed with giant cells containing typical cartilage and bone tissue. Classified as osteochondrosarcoma.

Case xviii. Morton[28] (1904). Female patient, sixty-four years old. A hard tumor with many areas of calcification. Radical breast amputation was performed. Fifteen months later a similar tumor was removed from the gluteal region, another later from the finger. Classified as calcifying chondrosarcoma.

Case xix. Heuter and Karrenstein[29] (1906). Female patient, thirty-seven years old. Breast contained a cyst filled with hemorrhagic necrotic tissue. Radical breast amputation was performed. Death from metastases to lungs. Classified as osteosarcoma.

Case xx. Sehrt[30] (1907). Female patient, forty-four years old. A fatty tumor with small points of cartilage formation and ossified portions was treated by radical breast amputation. Classified as osteochondrosarcoma.

Case xxi. Chevrier and Delval[31] (1910). Female patient, fifty-six years old. A non-encapsulated mass with several kinds of tumor; fibrous, fibrocartilaginous, bone, islands of breast tissue. Classified as fibromyxo-chondro-osteoma.

Case xxii. Jaki[32] (1919). Female patient, seventy-six years old. A tumor with gray periphery and white chalky trabeculae. Classified as chondro-osteo-endothelioma.

Case xxiii. McIver[33] (1923). Female patient, sixty years old. A hard, bony tumor with alveolar processes in the center containing teeth. Trabeculae of osteoid tissue and areas of cartilage present. Tumor present three months. Radical breast amputation performed. Patient died thirteen days postoperative from a pulmonary embolism. Classified by author as teratoid mixed tumor.

Case xxiv. Kreibig[34] (1925). Female patient, twenty-five years old. A carcinomatous tumor with central hard portions composed of cartilage and bone. Described by author as an osteosarcoma combined with fibroma, cavernoma and carcinoma.

Case xxv. Fowler[35] (1925). Female patient, sixty-seven years old. Tumor classified as an osteochondroma. Tumor was excised.

Case xxvi. Dyke[5] (1927). Female patient, fifty years old. A tumor containing a large rough-edged cavity with ossifying tissue. Tumor present one year. Treated by simple breast amputation. Classified as a teratoid mixed tumor.

Case xxvii. Edelmann[36] (1927). Female patient, sixty-one years old. A soft tumor with one hard area. Tumor composed of cystic and myxomatous tissue with small bony protuberances. Classified by author as a mixed tumor.

Case xxviii. Fry[11] (1927). Female patient, fifty-five years of age. A hard calcareous tumor with areas of hemorrhage. Microscopic examination showed irregular spindle-shaped cells, giant cells, trabeculae of osteoid tissue, calcification. Classified as an osteoclastoma.

Case xxix. Kaufman[37] (1929). Female patient, fifty-two years old. Tumor listed as an osteochondrosarcoma. No description given.

Case xxx. Kaufman[37] (1929). Female patient, forty-six years old. Tumor listed as an osteoid sarcoma. No description given.

Case xxxi. Busser[38] (1929). Female patient, fifty years old. A tumor containing adenofibroma, cartilage, osseous tissue with osteoblastic cells. Treated by radical breast amputation. Classified by the author as osteochondroblastic sarcoma.

In almost every instance the author in reporting his case has given the tumor a different pathological name; there are 4 cases of osteochondroma, 3 cases of calcifying spindle-cell sarcoma and several mixed tumors, variously labelled as teratoid mixed tumors, chondro-osteo-endothelioma, sarcoma containing bone and adenoid tissue, etc. The essential points in the gross and microscopic pathological description of each tumor as recorded by the author are recorded. Many of these descriptions are obviously incomplete. The first authentic case is that of Cooper[14] in 1836, a cartilaginous and bony tumor of the breast which had been observed for fourteen years in a woman thirty-two years old. The teratoid mixed tumors are exemplified by the cases reported by Dyke[5] and McIver[33]; alveolar tissue and even teeth were present. The sex is given in 26 patients showing these tumors; all of the 26 were females. The age is given in the same number of cases, 18 of which were in patients in the fifth and sixth decades. It will be seen from the list that Durham's[22] case was a woman of twenty-seven with a sarcoma containing bone; Sehrt's[30] was an

osteochondrosarcoma in a woman of forty-four; Kaufman's[37] an osteoid sarcoma in a patient of forty-six years and Clarke's[23] a calcifying chondrosarcoma in a woman of forty-six years. A calcifying chondrosarcoma is also reported by Battle[24] in a woman seventy-three years old. Jaki's[32] patient was seventy-six years of age and the tumor was described as a chondro-osteo-endothelioma.

The fact that the majority of calcified tumors have been observed in patients of advanced age suggests that the calcification in the breast may develop as an accompaniment to other changes in advanced age, such as the sclerosis of arteries in older people.

A study of the surgical treatment undertaken and the results obtained by the various authors is not enlightening. Simple excision of the tumor, removal of the breast and radical amputation of the breast have all been performed in dealing with this condition. Radical amputation of the breast might well have been the operation selected in the case herein reported, had it not been for the *x*-ray appearance of the lesion which defined it as a circumscribed mass.

In recent investigations, the value of soft tissue *x*-rays in the diagnosis of breast tumors has been emphasized (Carty[12]). The transillumination method advanced by Cutler,[13] which makes it possible to outline the margins of a breast tumor and to determine fairly well whether the lesion is circumscribed or invasive, has been a diagnostic aid. In the literature, the presence of a calcified tumor in the breast was only once determined by *x*-ray. A radiological examination in Fry's[11] case showed calcareous nodules in the breast opposite the one containing the tumor.

SUMMARY

1. A case of a calcified retention cyst of the female breast is reported.

2. An *x*-ray study of the breast served to suggest the benign nature of the lesion. On the basis of this observation, local excision was considered safe and the patient was spared a radical breast resection.

3. A survey of the literature shows that there are only 31 authentic reports of tumors of the breast containing calcium or bone. The tumors are differentiated as (a) teratoid mixed tumors, (b) calcifying sarcomata or carcinosarcomata, and (c) benign calcified retention cysts.

REFERENCES

1. Velpeau, A. Traité des maladies du sein et de la region mammaire. Paris, Masson, 1854.
2. Morgagni, G. B. De sedibus et causis morborum. Vol. 3: 42, 1779.
3. Deaver and McFarland. The Breast: Anomalies, Diseases, Treatment. Phila., Blakiston, 1917, p. 358.
4. Lubarsch and Henke. Handbuch d. speziel. Path. u. Anat., p. 227.
5. Dyke, S. C. *Brit. J. Surg.*, 14: 323, 1926.
6. Ewing, J. Neoplastic Diseases. Phila., Saunders, p. 538, 1931.
7. Virchow, R. *Verb. d. med. Gesellsch.* 1: 137, 1850.
8. Cornil and Souligoux. *Bull. Soc. d'Anat.*, 80: 28, 1910. (See Ewing.)
9. Cushing and Ortschild. *Bull. Johns Hopkins Hosp.*, 16: 186, 1905.
10. Bryk, A. *Langenbecks Arch.*, 25: 808, 1880.
11. Fry, H. J. *J. Path. & Bact.*, 30: 529, 1927.
12. Carty, J. R. *Radiology*, 22: 508, 1934.
13. Cutler, M. *Ann. Surg.*, 93: 223, 1931.
14. Cooper, A. Illustrations of the Diseases of the Breast. London, 1829, p. 64.
15. Amann, J. *Beitr. z. Geburtsh. u. Gynäk.*, 4: 57, 1860.
16. Wagner. *Arch. f. Heilk.*, 2: 275, 1861.
17. Stilling, H. *Deutsche Ztschr. f. Chir.*, 15: 247, 1881.
18. Smith, W. *Trans. Path. Soc. London*, 22: 267, 1878.
19. Billroth, Th. *Deutsche Chir.*, 41: 58, 1880.
20. v. Hacker, V. *Langenbecks Arch.*, 27: 614, 1882.
21. Herteaux. *Mem. d. la Soc. de chir.*, 7: 1, 1882. (See Arnold.)
22. Durham, A. E. *Brit. M. J.*, 2: 1019, 1883.
23. Clarke, W. B. *Trans. Path. Soc. London*, 41: 229, 1890.
24. Battle, W. H. *Trans. Path. Soc. London*, 37: 473, 1886.
25. Leser, E. *Zieglers Beitr.*, 2: 381, 1888.
26. Pilliet, A. *Bull. Soc. d'anat.*, 4: 552, 1890.
27. Arnold, St. *Virchows Arch.*, 148: 449, 1897.
28. Morton, C. A. *Trans. Path. Soc. London*, 55: 327, 1904.
29. Heuter and Karrenstein. *Virchows Arch.*, 183: 495, 1906.
30. Sehrt, E. *Bruns Beitr. z. klin. Chir.*, 55: 574, 1907.
31. Chevrier and Delval. *Bull. Soc. d'anat.*, 85: 586, 1910.
32. Jaki, J. *Deutsche Ztschr. f. Chir.*, 219: 413, 1929.
33. McIver, M. A. *Ann. Surg.*, 77: 354, 1923.
34. Kreibig, W. *Virchows Arch.*, 256: 649, 1925.
35. Fowler, F. E. *Northwest Med.*, 24: 122, 1925.
36. Edelmann, H. *Beitr. z. path. Anat. u. Path.*, 78: 618, 1927.
37. Kaufman, E. Pathology. Blakiston's Sons, Vol. 3, pg. 1784.
38. Busser, F. *Ann. d'anat. path.*, 6: 1274, 1929.

ACUTE PERFORATED PEPTIC ULCER*

(A REVIEW OF SIXTY-THREE CASES)

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THIS paper was prompted by the sudden recent influx of acute perforations that entered the Temple University Hospital during the year 1934. Approximately one-fifth of all the cases recorded from October, 1922 to January, 1935 entered the hospital during that year (1934). Over a period of twelve years there have been 63 cases of acute perforated peptic ulcer in 60 patients. One of these patients had three separate perforations. Another entered the hospital moribund and was not operated upon.

AGE INCIDENCE

Perforated ulcer is a condition that usually occurs in the fourth decade, although it may happen at almost any age. In our series, the average age was thirty-seven years; the youngest patient was a boy of seventeen years, and the oldest a woman of seventy. Both recovered from the operation. Stern, Nessa and Perkin[1] report a case of perforated gastric ulcer in a child two days old. Other cases have been reported at two weeks and two months of age. The oldest case recorded in the literature was in a man seventy-five years of age. This case was reported by A. R. Montgomery.[2]

SEX INCIDENCE

Of these 63 cases in this series, only 4 were in females. In the report of Eliason and Ebeling[3] of their 74 cases, only one patient was female. H. K. Shawan[4] reports 227 gastroperforations with only 4 occurring in women. Meyer and Brams[5] give a series of 62 cases, all of which occurred in males. The condition, then, is preeminently that of the male.

TYPES OF ULCER

In our series there were 52 duodenal ulcers and 11 gastric ulcers, a ratio of almost 5 to 1. Eliason and Ebeling[3] showed 60 duodenal and 14 gastric perforations in their series. Five to 1 is about the average ratio of duodenal to gastric perforations as shown in most clinics.

PREVIOUS HISTORY

Eighty-five per cent of our cases gave a previous history of gastrointestinal disturbance, for a year or more. These cases showed the typical syndrome of hunger causing pain and food relieving the pain. Ten per cent gave histories of less than a month. Their chief symptoms before perforation were pain, more or less constant, and not relieved by food. Five per cent gave no history of previous disturbance, their first symptom being perforation.

SYMPTOMATOLOGY

In this paper symptomatology will not be gone into in detail. Suffice it to say, that the story of a pain in the midepigastrium so severe and so sudden that it threw the patient to the floor in a cold sweat, was read in the histories often enough to become monotonous and thereby characteristic. The same holds true for the single physical sign, board-like rigidity of the entire abdomen. A few cases showed obliteration of liver dulness, indicating

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free gas below the diaphragm which was shown by *x*-ray, but even though this is an important and almost pathognomonic sign, it did not occur often enough to be of real value statistically.

TYPES OF OPERATION

In this hospital five types of procedure have been used.

1. *Simple Suture.* This was the most common type of procedure. Thirty-one cases were handled in this manner. There were 8 deaths (26 per cent mortality).

TABLE 1
TYPES OF OPERATION

Type of Operation	Cases	Deaths	Mortality (Per Cent)
Simple suture	31	8	26
Simple packing	14	5	35.7
Resection and pyloroplasty	11	2	18.1
Resection and gastroenterostomy	2	0	0
Omental suture	2	0	0

2. *Simple Packing to Ulcer Area.* Fourteen of these were done with 5 deaths (35.7 per cent mortality). It is to be understood, of course, that these cases were the poorest risks, having gone the longest time between perforation and operation, and usually having a spreading peritonitis at operation, and having in some cases perforations too large or tissues too friable for suture. One of these patients had a subsequent ileostomy just before death.

3. *Resection and Pyloroplasty.* Eleven of these were done with 2 deaths (18.1 per cent mortality). This procedure was reserved only for good risks.

4. *Resection and Posterior Gastroenterostomy.* Two cases were thus treated with no mortality. Naturally, this was done only in the best risks.

5. *Suture of Omentum over Perforation.* This was done twice with no mortality.

One case which was seen at this hospital on the fifth day after perforation was diagnosed pelvic inflammatory disease. The patient had most of her pain in the right lower quadrant. A vaginal section was done and a cul-de-sac abscess drained twenty days after the perforation. Autopsy on the twenty-fourth day after perforation showed a generalized peritonitis due to a ruptured duodenal ulcer.

From the literature it is seen that simple suture is the most favored procedure. H. K. Shawan[4] of the Detroit Receiving Hospital reported 227 cases from 1920 to 1933. There were three types of operation used:

1. Simple closure: 168 cases; 41 deaths (25 per cent mortality).

2. Excision and pyloroplasty: 36 cases; 8 deaths (22 per cent mortality).

3. Closure and gastroenterostomy: 22 cases; 5 deaths (22.7 per cent mortality).

Rhodes and Collins[6] reviewed 155 cases in which simple closure was done in 67 cases, pyloroplasty in 33 cases and closure and posterior enterostomy in 55 cases. Their total mortality was 25 per cent.

A. M. Graves[7] of Tulane reviewed 4402 perforated peptic ulcers in German clinics from 1897 to 1931. Simple closure, reserved for the poorest risks, was done most often with a mortality of 50 per cent. Gastroenterostomy, reserved for the better risks, gave 13.8 per cent mortality. Gastric resection, reserved for the best risks, gave only 5 per cent mortality. Their total mortality was 23 per cent.

D. N. Guthrie[8] did simple suture with drainage in all of his series of 42 cases. There was a 16.6 per cent mortality.

C. L. Gibson[9] did simple closure with drainage in 109 of 123 cases. His total mortality was 18.6 per cent. Of the 109 cases of simple suture his mortality was 17.4 per cent.

Most men in this country feel that in perforated ulcer, operation is a life-saving measure and that nothing outside of suture of the perforation should be done in the way of treating the ulcer. This should be done if necessary, at a secondary operation.

TYPES OF DRAINAGE

In this series 5 were closed without drainage. Two patients died (40 per cent mortality). There were three types of drainage used.

1. *Drainage to Ulcer Area and Pelvis* (the latter through a suprapubic stab wound). This was the most common type of drainage. Of the 32 cases, drained in this manner, 12 patients died, a mortality of 37.5 per cent. This mortality, of course, is not due to the type of drainage, but to the fact that these cases had the most free fluid and peritonitis. This double drainage was used only in those cases showing an excessive peritonitis or an excessive amount of infected fluid.

TABLE II
TYPES OF DRAINAGE

Type of Drainage	Cases	Deaths	Mortality (Per Cent)
No drainage	5	2	40
To ulcer area and pelvis	32	12	37.5
To ulcer area only	12	2	17
To pelvis only	12	0	0

2. *Drainage to Ulcer Area Alone.* This was done in 12 cases with 2 deaths (17 per cent mortality). This type of drainage was used where the fluid was more or less localized to the ulcer area or where only a small amount of fluid had escaped.

3. *Drainage to Pelvis Alone through Suprapubic Stab Wound.* This was done in 12 cases with no deaths. This was used where only a small amount of fluid had escaped or more or less as a prophylactic against pelvic abscess.

The great majority of surgeons, both in this country and abroad, drain most of their cases. However, there are some clinics which close every case routinely, since they believe that it is impossible to drain an entire peritoneal cavity by one or two tubes. H. H. Trout[10] reported 41 cases in which he closed the abdomen without drainage. The operation in most cases was a simple closure. In a number of cases, however, a posterior enterostomy was done. His mortality was 22 per cent. His operative mortality was 17 per cent, since 2 of his patients died without being operated upon. However, of the 41 cases, 4, or 10 per cent, developed secondary abscesses which had to be reopened. This is the greatest objection to closure without drainage. One of these 4 patients died. The consensus of opinion throughout the United States is that perforated ulcers should be drained not routinely, but in most cases, and especially those which have gone over six hours.

Gastric drainage, which has become popular since Wangensteen introduced his continuous suction apparatus, has done a great deal to reduce the morbidity in perforated ulcers. It has been used in every case handled at this hospital for about the last two years. It has taken the tension off these sutured perforations and so has reduced not only the morbidity, but also the mortality, since before this apparatus was used, although the Jutte tube helped some, nevertheless, there have been cases in which sutured perforations have reopened due to acute gastric dilatation and the peritoneal cavity has been re-flooded with gastric or duodenal contents to the detriment, and frequently, the demise of the patient. It should be used routinely on every case of perforated ulcer.

ANESTHESIA

In this hospital there were used five types of anesthesia.

1. *Spinal Anesthesia.* a. Stovaine. Until 1931, stovaine was used in this hospital. The average dose was 6 cg. It was given usually in the first or second lumbar interspace. Twenty-seven of our cases received stovaine. The mortality in this group was 14.8 per cent.

b. Procaine. This was used after 1931. The average dose was 120 mg. and it was also given in the first or second lumbar interspace. Twenty-one cases received pro-

caine. The mortality in this group was 22.7 per cent.

TABLE III
TYPES OF ANESTHESIA

Type of Anaesthesia	Cases	Deaths	Mortality (Per Cent)
Spinal			
Stovaine	27	4	14.8
Procaine	21	5	22.7
Local			
1 per cent novocaine	7	5	71
Gas			
Ethylene	3	1	33
Nitrous oxide	3	1	33
Ether	1	0	0

2. *Local Anesthesia.* One per cent novocaine locally was used in 7 cases. The mortality in this group was 71 per cent. We must be careful not to blame the anesthesia for the deaths. Novocaine was used only in those cases which were such poor risks that not even gas was thought safe. Naturally, the mortality would be highest in this group.

3. *Ethylene or Nitrous Oxide.* Six patients were given one or the other of these gases. One that had ethylene and one that had nitrous oxide died. The mortality in this group was 33 per cent.

4. *Ether.* This was used in only one case. The patient survived.

There are two interesting facts to note in relation of mortality to anesthesia: (1) Stovaine, which is supposed to be much more toxic than procaine, showed a mortality of 14.8 per cent while procaine gave a mortality of 22.7 per cent. (2) Spinal anesthesia, the use of which is thought to be contraindicated in perforated ulcer by a number of surgeons, shows a lower mortality (17 per cent) than any other anesthesia. This is similarly shown in the report of Eliason and Ebeling[3] in which they used ether in 24 cases with 12 deaths (50 per cent), gas and ether in 24 cases with 13 deaths (54 per cent), spinal anesthesia in 13 cases with 4 deaths (30 per cent), and local anesthesia in 9 cases with 4 deaths (44 per cent).

Without doubt, spinal anesthesia gives the best relaxation, thus shortening the time of operation, the intra-abdominal manipulation and thus helps to decrease both the morbidity and the mortality.

MORTALITY

Our gross mortality was 28.8 per cent; however, since one patient died before operation, our operative mortality was 25.8 per cent. This is close to the average mortality throughout the country, which is 25.9 per cent as is shown in Eliason and Ebeling's[3] paper in which they averaged the mortality of 44 individual series of perforated ulcers published in this country since 1921. Our mortality in 1923 was 50 per cent. In 1934, it was reduced to 18 per cent. In the article of Graves[7] the mortality in the German clinics is reported as 68 per cent in 1897, and 17 per cent in 1931.

It is logical to believe that medication and food taken after perforation is an important factor in increasing peritonitis and so increasing the mortality. From the study of the cases in this series, it would appear not so important, for in 19 patients from whom a history of food or medication being taken after perforation was obtained, 61 per cent lived, and 39 per cent died. Also, it was shown that in 80 per cent of the cases, when food or medication was taken after the perforation had occurred, it was promptly vomited. It is due to this vomiting reflex which is so protective and so common in irritation anywhere along the gastrointestinal tract, that most of the material is prevented from entering the peritoneal cavity after perforation, and so less peritonitis occurs.

It was thought that the time consumed at operation might be a factor in influencing the mortality. Contrary to expectations, it was shown that those patients who lived had an average longer operating time (fifty minutes) than those who died (thirty-nine minutes). This means simply that the patients who were in better condition had the longer and more therapeutic operations such as pyloroplasty

and gastroenterostomy. That they were in better condition was due to the fact that they had a shorter time interval between perforation and operation as will be shown in the next paragraph.

Without doubt, the greatest single factor affecting mortality is the time element between perforation and operation. The greatest single cause of death is peritonitis, and both death and peritonitis are directly proportional to the time elapsing between perforation and operation. The average time between perforation and operation for those patients who lived was nine and one-half hours. For those who died it was thirteen and one-half hours.

TABLE IV
RELATION OF INTERVAL BETWEEN PERFORATION AND OPERATION TO MORTALITY

Time Interval (Hrs.)	Cases	Deaths	Mortality (Per Cent)
0–6	22	2	9
6–12	22	4	18
12–18	4	1	25
18–24	7	6	85
Over 24	6	3	50

There were 22 patients operated on before six hours had elapsed with only 2 deaths (9 per cent mortality); 22 were operated on between six and twelve hours with 4 deaths (18 per cent mortality); 4 were operated on between twelve and eighteen hours with 1 death (25 per cent mortality); 7 were operated on between eighteen and twenty-four hours with 6 deaths (85 per cent mortality), and 6 were operated on over twenty-four hours following perforation with 3 deaths (50 per cent mortality).

Of the patients operated on before six hours, one died on the third day after operation of pulmonary embolus. The other died on the eleventh day postmortem, showing a localized peritonitis, but more important, a suppurative pneumonitis. This was shown by *x*-ray and bronchoscopy before death. There were no deaths from peritonitis itself in this group.

Of the 4 deaths in patients operated on between six and twelve hours, one died of exhaustion from postoperative insanity thirteen days after operation, one died of lobar pneumonia, one died of peritonitis, and one died of extensive peritonitis plus bronchopneumonia and hemorrhage into the lung. In this group then, 50 per cent died of peritonitis.

TABLE V
RELATION OF CAUSES OF DEATH TO TIME INTERVAL BETWEEN PERFORATION AND OPERATION

Time Interval (Hrs.)	Peritonitis	Cardiac	P.O. Insanity	Pulmonary
0–6	0	1	0	1
6–12	2	0	1	1
12–18	1	0	0	0
18–24	6	0	0	0
Over 24	3	0	0	0

The single patient operated on between twelve and eighteen hours following perforation died of peritonitis.

Of the six deaths in patients operated on between eighteen and twenty-four hours, all died of peritonitis.

Of the 3 that went over twenty-four hours, one went seventy-two hours, dying of peritonitis. One went twenty days before she was operated upon, dying four days later of peritonitis, this case being the one that was diagnosed pelvic inflammatory disease on admission; the third went forty-six hours, dying of peritonitis.

In our cases then, the causes of death were: (1) pulmonary embolus, 5 per cent; (2) pneumonic involvement, 20 per cent; (3) peritonitis, 75 per cent.

SUMMARY AND CONCLUSIONS

1. Sixty-three cases of acute perforated gastric and duodenal ulcers admitted from October, 1922 to January, 1935 are reviewed.

2. Simple suture of the perforation is the safest procedure, therapeutic surgery for the ulcer coming at a secondary operation.

3. Some form of drainage should be used in the routine case.

4. In the proper hands, spinal anesthesia is a safe anesthetic, and in this series gave the lowest mortality of the anesthetics used.

5. Peritonitis is the greatest single cause of death in perforated ulcer, and in this series was the cause of death in 100 per cent of the cases operated on after twelve hours.

6. Peritonitis and death are directly proportional to the time interval between perforation and operation.

REFERENCES

1. Stern, Nessa and Perkin. *J. Lancet*, 49: 492, 1929.
2. Montgomery, A. R. *Brit. M. J.*, 1: 433, 1930.
3. Eliason and Ebeling. Am. J. Surg., 24: 63, 1934.
4. Shawan, H. K. *Ann. Surg.*, 98: 210 (Aug.) 1933.
5. Meyer and Brams. *Am. J. M. Sc.*, 171: 510, 1926.
6. Rhodes and Collins. *Calif. & West. M.*, 39: 173 (Sept.) 1933.
7. Graves, A. M. *Ann. Surg.*, 98: 197 (Aug.) 1933.
8. Guthrie, D. N. *N. York J. M.*, 23: 66, 1923.
9. Gibson, C. L. *J. A. M. A.*, 91: 1006, 1928; *Am. J. M. Sc.*, 165: 807, 1923.
10. Trout, H. H. *J. A. M. A.*, 104: 6 (Jan.) 1935.

RFERENCES OF DR. ADAMS

Ardouin, P. Encephalocele with report of 2 cases; indications and contraindications for intervention. *Paris méd.*, 89: 87, 1933.

Bender, E. Sincipital hydrocephalocele with deformation of nose; case. *Arch. f. klin. Chir.*, 161: 625, 1930.

Birch-Hirschfeld. Die Krankheiten der Orbita. In Graefe-Saemisch: Handbuch der gesamten Augenheilkunde, 1915.

Borra, V. Large cerebral hernia from mero-acrania; case. *Pediatria d. med. prat.*, 6: 83–96, 1931.

Contardo, G. B. Meningo-encephalocystocele; morphologic and pathologic study; case. *Folia Gynaec.*, 30: 295, 1933.

Cordes, E. *Payr. Kuttner's Erg.* 22: 258, 1929.

Cutelli, P. Cephalocele; case. *Riforma med.*, 46: 703, 1930.

Dandy, W. E. An operative treatment for certain cases of meningocele or encephalocele into the orbit. *Arch. Opbth.*, 2: 123, 1929.

Elmalek, S. Encephalocele in nasal region. *J. Anat.*, 66: 264, 1932.

Esau, P. Occipital hydrencephalocele and spina bifida with coordinated spinal deformities, observation of a patient eleven years after surgical intervention. *Arch. f. klin. Chir.*, 171: 445, 1932.

Faggioli, R. Large hydro-encephalomeningocele in newborn infant; case. *Semana med.*, 2: 1555–1556, 1932.

Gragert, O. Partial absence of skull (mero-acrania) with sagittal encephalocele (podencephalus); study of palpatory and roentogenolgic antepartum diagnosis of cranial malformations. *Ztschr. f. Geburtsh. u. Gynäk.*, 104: 322–337, 1933.

Gross, S. W., and Sachs, E. Spina bifida and cranium bifidum. A study of 103 cases. *Arch. Surg.*, 28: 874, 1934.

Hallermann, O. Intranal meningoceles and their clinical diagnosis. *Ztschr. f. Hals-Nasen u. Ohrenh.*, 30: 413, 1932.

Jaensch, P. A. Congenital hydrophthalmus and encephalocele of posterior orbit; case. *Ber. u. d. Versamml. d. deutsch. opbth. Gesellsch.*, 47: 455, 1929.

Jemma, G. Prognosis and treatment of cephalocele. *Pediatria*, 38: 1–24, 1930.

Kimura, T. Parietal hydromeningo-encephalocele with abnormal location of placenta and velamentous insertion of umbilical cord. *J. Kumanoto M. Soc.*, 9: 370, 1933.

Klots, T. S. Operation for spina bifida and meningocele; report of case. *Nederl. Tijdschr. v. Geneesk.*, 2: 884 (Aug.) 1934.

de Lange, C. Morphologic changes in brain and S. C. in posterior encephalocele; case. *Jahrb. f. Kinderh.*, 126: 253–288, 1930. Abst.: *Nederl. Tijdschr.*, 74: 961, 1930.

Lestache, Garrido. Meningo-encephalocele of superior occipital region in child. *Pediatria espan.*, 21: 85–89, 1932.

Macphail, R. M. Large occipital meningocele. *Brit. M. J.*, 1: 179–180, 1931.

Micholitsch, T. Hydromeningo-encephalocele occipitalis case. *Zentralbl. f. Gynäk.*, 53: 1588 (June) 1929.

Mussgnug, H. Cranial malformations in naso-orbital encephalocele. *Frankfurt Ztschr. f. Path.*, 42: 238–249, 1931.

Natanson, L. Intranasal cephalocele. *Arch. f. Ohren-, Nasen- u. Kehlkopfh.*, 135: 103, 1933.

Ostertag, B. Importance of small hernias. *Deutsche Ztschr. f. Nervenh.*, 116: 155, 1930.

Palmero, P. Meningo-encephalocele. *Brazil med.*, 1: 198, 1922. Abst.: *J. A. M. A.*, 79: 923, 1922.

Pearl, J. Meningo-encephalocele naso-orbitalis; a case. *Ginek. Polska*, 12: 501, 1933.

Penfield, W., and Cone, W. Spina bifida and cranium bifidum; results of plastic repair of meningocele and myelomeningocele by new method. *J.A. M. A.*, 98: 454–461, 1932.

Prout, C. T. Cortical herniations. *J. Nerv. & Ment. Dis.*, 74: 468–477, 1931.

Robot. Encephalocele; 1 case. *Bull. Soc. d'Obst. et de Gynec.*, 22: 624, 1933.

Santainarina, V. Hydrencephalomeningocele; case. *Arch. de med. inf.*, 1: 70–83, 1932.

Schreiber, F. Suboccipital meningocele masking symptoms of brain abscess; case. *J. Michigan M. Soc.*, 29: 433, 1930.

Sievers, R. Right naso-orbital encephalocele cured by trepanation; case. *Deutsche Ztschr. f. Chir.*, 221: 289–302, 1929.

Sorrentino, B. Encephalocel; case. *Riforma med.*, 47: 31–33, 1931.

Sternberg, H. Embryologic causes of anterior encephalomeningocele. *Wien. med. Wchnschr.*, 79: 462 (March) 1929.

del Torto, P. Operative intervention in new-born infant for occipital meningocele. *Ann. ital. de chir.*, 12: 1037, 1933.

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CLINICAL ASPECTS OF

GASTROJEJUNAL ULCER*

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THE occurrence of gastrojejunal ulcer (marginal, stomal or anastomotic ulcer) after gastroenterostomy is recognized as one of the most serious problems in modern gastric surgery. The fear of its occurrence has led many European and American surgeons to abandon the operation of gastroenterostomy and to substitute extensive gastric resection for duodenal or gastric ulcer. It seems pertinent, therefore, to review briefly the important clinical aspects of gastrojejunal ulcer, particularly in the light of recent investigations.

TIME OF OCCURRENCE AFTER OPERATION AND FREQUENCY

In the majority of cases, gastrojejunal ulcer appears soon after gastroenterostomy is done, but not infrequently it may appear after an interval of many years. Balfour reported that in 56.7 per cent the symptoms reappeared within one year, but in one case the postoperative interval was twelve years. The average length of time between the primary operation and that for gastrojejunal ulcer was four and one-half years. In one case mentioned by Lahey, gastrojejunal ulcer appeared nineteen years after the primary operation.

The fact that gastrojejunal ulcer may not appear for a long time after gastroenterostomy throws considerable doubt upon the reported frequency of this lesion, which has been variously estimated at from 1.6 per cent (Walton) to 34 per cent (Lewisohn). Hinton and Church have recently emphasized the point that a ten-year follow-up period is essential in drawing conclusions, and, moreover, they insist that follow-up by letter is inaccurate and misleading. In a series of 79 gastroenterostomies followed for less than five years, they found gastrojejunal ulcer in 16.4 per cent. Emery and Monroe recently reported a series of 480 gastroenterostomies followed for a period of ten years, with an incidence of gastrojejunal ulcer of 9.7 per cent. In 1930, Balfour reported a series of 600 gastroenterostomies followed for ten years; in 500 cases in which gastroenterostomy had been done for duodenal ulcer the incidence of gastrojejunal ulcer was 3.26 per cent, whereas in 100 gastroenterostomies for gastric ulcer no case of gastrojejunal ulcer occurred. It seems evident, therefore, that the reported incidence of gastrojejunal ulcer will vary, depending upon such factors as the length of the follow-up period, the care with which patients are observed after operation, the nature of the original lesion and the associated gastric phenomena, the race of the patients, the quality of surgical technique, and the presence of foci of infection or other etiologic agents.

DIAGNOSIS

The clinical diagnosis of gastrojejunal ulcer in most cases is readily made on the basis of the clinical picture and the roentgenologic findings. In some cases it will be difficult to establish the diagnosis definitely, and to decide between gastrojejunal ulcer on the one hand, and reactivation of the original ulcer, malfunctioning gastroenterostomy, nervous dys-

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pepsia, and associated intra-abdominal or distant disease, on the other. A painstaking history and examination usually enables one to arrive at the correct diagnosis.

Clinical study of the patient's symptoms and the effect of treatment is of great importance, and often is more dependable than the roentgenologic data. The patient usually experiences a recurrence of his former ulcer syndrome, with one important difference. Eusterman has shown that there is usually a change in the location of pain, which in 85 per cent of cases was located farther to the left and lower than the original pain. Pain may be located in any part of the abdomen, in either iliac fossa or in the back (Wright, 1935), and it may even radiate down to the scrotum. Vomiting is a frequent accompaniment of the pain. Hemorrhage is more frequent in cases of gastrojejunal ulcer than before operation, and its occurrence after gastroenterostomy, particularly if the original lesion was non-hemorrhagic, should make one suspect the presence of gastrojejunal ulcer. Walton reported hemorrhage in 32 of 79 cases of gastrojejunal ulcer (40 per cent). An important lead in clinical diagnosis is afforded if the patient obtains complete or partial relief on medical ulcer management. The clinical picture may vary considerably in the presence of complications, chief among which are hemorrhage, perforation and gastrojejunocolic fistula. Perforation occurred in 5 per cent of Wright's series of 155 cases and in 9 per cent of Lahey's series. Gastrojejunocolic fistula occurs in approximately 10 per cent of cases (Lahey, Verbrugge). A barium enema to exclude the latter complication should be routine in all patients having a recurrence of symptoms after gastroenterostomy.

The roentgenologic diagnosis of gastrojejunal ulcer is extremely difficult in many cases, and consequently a negative report should be accepted by the clinician with considerable reserve. Close cooperation between the internist, the surgeon and the roentgenologist is essential in all postoperative cases. Camp has reported an accuracy of 90 per cent, but this represents the experience of an unusually capable roentgenologist who has had an opportunity of examining a large series of cases. Camp bases his diagnosis upon four criteria: (a) the presence of a niche; (b) persistent deformity at the stoma or of the stomach or jejunum in the region of the stoma; (c) the presence of a gastrojejunocolic fistula; (d) closure of the stoma.

TREATMENT OF GASTROJEJUNAL ULCER

The medical treatment of gastrojejunal ulcer is admittedly unsatisfactory. Of 8 patients treated medically, Lahey reported that 3 were well for a period varying from three to nine months. At present, the majority of cases will require surgical treatment. Most surgeons agree that partial gastrectomy is the operation of choice. Occasionally, if the pylorus is patent and the original lesion in the duodenum healed, simple disconnection of the gastroenterostomy may be sufficient; but since this maneuver reestablishes the original anatomical conditions there is great probability of recurrence of ulcer in the duodenum. Walton tried local excision of the gastrojejunal ulcer in 13 cases, with recurrence of gastrojejunal ulcer in 6 cases. The incidence of recurrent gastrojejunal ulcer after partial gastrectomy is low, probably about 0.5 per cent, but it is important to know that it does occur and that the mere recovery of the patient from the operation does not always mean a successful future. Partial gastrectomy, therefore, may be considered the best of the available methods of surgical treatment, but it cannot be accepted as a final or wholly satisfying solution. Birgfeld reported 53 cases of gastrojejunal ulcer after partial gastrectomy. Balfour (1928) reported 28 cases of recurring ulcers following partial gastrectomy; in 14 cases the resection had been done for gastric ulcer, in 8 for duodenal ulcer, and in 6 for gastrojejunal ulcer.

Among the sequelae of partial gastrectomy may be mentioned anemia, gastro-

intestinal motor disturbances, nutritional impairment, and a hypoglycemic state. Walton, in a series of 794 cases of partial gastrectomy, saw only 6 cases in which anemia developed postoperatively, and in all of these the anemia was of the secondary type. Experimentally, Ivy and his co-workers, and others, have been unable to provoke a hyperchromic, macrocytic type of anemia in a single case of gastrectomy in animals. Lapp and Diebold, Beckermann, and others have described the occurrence of a hypoglycemic state in patients after partial gastrectomy, the symptoms being similar to an insulin reaction. Weir has studied a group of 57 patients who had further symptoms after partial gastrectomy, and classifies his patients as follows: (a) those with a sensation of diminished capacity of the stomach; (b) those with the syndrome of rapid emptying; (c) those with mechanical difficulties; and (d) those with recurrent ulceration. Recently Emery, working with dogs, found a lessened absorption of fat and protein after total gastrectomy, and he concluded that this was due to rapid gastric emptying and increased intestinal motility rather than to disturbed chemistry.

PREVENTION OF GASTROJEJUNAL ULCER AND RECURRENT GASTROJEJUNAL ULCER

This is likely to be unsatisfactory until we determine the ultimate causative factors of ulcer, and establish an effective curative or preventive treatment based upon knowledge of etiology or pathogenesis. Lacking such important knowledge, the surgeon today would gain tremendously if it were possible to decide in advance which patients will develop gastrojejunal ulceration after gastroenterostomy. Much work along these lines has been done, but it must be admitted that our knowledge is still incomplete and inadequate.

This is not the place to discuss in detail the many factors concerned in the etiology of ulcer, but a few facts relating to gastrojejunal ulcer will be of interest. Most cases of gastrojejunal ulcer occur after gastroenterostomy for duodenal ulcer; it is relatively uncommon after gastroenterostomy for gastric ulcer, and almost unknown when the operation is done for carcinoma of the stomach, although Judd has reported a case. Paterson reported a case in a child of two months, in whom the operation had been done for congenital pyloric stenosis. Von Redwitz and Fuss have pointed out that it is the young patient with an acute ulcer and pyloric obstruction who is most likely to develop gastrojejunal ulcer. Men are much more commonly affected than women. Race and temperament play some part, for gastrojejunal ulcer is more common in Jews and in nervous, high-strung individuals. There is some reason for believing that the presence of foci of infection tends to increase the likelihood of gastrojejunal ulcer, but foci are not more common in men than in women, so that this cannot be the sole cause. Regarding the rôle of gastric secretion, the evidence is conflicting. Experimental work tends to emphasize the importance of this factor, but Emery and Monroe found no relation between acidity and the incidence of gastrojejunal ulcer. In Balfour's series of gastrojejunal ulcer, 40 per cent had approximately normal acidity, 40 per cent marked reduction, and 20 per cent had achlorhydria. In Balfour's series of recurrent gastrojejunal ulcer, 55 per cent had reduced gastric acidity and 20 per cent had no free hydrochloric acid. In spite of these facts, the clinical impression persists that gastrojejunal ulcer is more likely to occur in patients with high gastric acidity or with an increased amount of gastric secretion, particularly if the acidity is controlled with difficulty by medical management. Perhaps too much attention has been given to the acid content of the gastric juice and not enough to the other constituents and to the neutralizing factors in the upper gastrointestinal tract. From

this consideration of etiology, it would seem that the Jew, the high-strung nervous individual, the patient with a large amount of gastric secretion of high acidity (particularly when symptoms are poorly controlled by medical treatment) and the patients with foci are the ones who are prone to develop gastrojejunal ulcer. But there is no certain method of telling in advance in a given case whether that individual will develop gastrojejunal ulcer. There is great need here for some accurate method.

In an effort to prevent gastrojejunal ulcer, all types of operations have been tried without great success. Many surgeons have abandoned gastroenterostomy and have substituted partial gastrectomy for duodenal ulcer; the object of such an operation is to produce anacidity or subacidity. As already mentioned, the incidence of gastrojejunal ulcer after partial gastrectomy is about 0.5 per cent; many surgeons feel that the incidence can be reduced to zero if resection is extensive enough to produce anacidity. However, it is not certain that gastric acidity is the only factor to be considered, or that partial gastrectomy impairs the ability of the fundus to secrete acid. Comfort found that only 20 per cent of cases after partial gastrectomy have anacidity. Klein, Aschner and Crohn found that of 197 cases of duodenal ulcer, anacidity occurred in only about 50 per cent after partial gastrectomy. The real reason for the lower incidence of gastrojejunal ulcer after partial gastrectomy still remains obscure; Comfort has suggested that a combination of factors probably explains the reduction of acidity, among which he mentions rapid emptying, reduction in volume of secretion, and dilution and neutralization by duodenojejunal content through the unguarded stoma. Moreover, against the lower incidence of gastrojejunal ulcer must be placed the greater technical difficulties of the operation and a higher operative mortality.

In conclusion, we may say that partial gastrectomy for duodenal ulcer represents a radical attempt to prevent a most distressing problem, but it cannot be accepted as a final answer. Many surgeons still feel that the results of gastroenterostomy warrant its continuation, and they do not feel justified in substituting for gastroenterostomy an operation that has, even in skilled hands, a higher average mortality than the average risk of gastrojejunal ulcer after gastroenterostomy. From a practical standpoint, operation for duodenal ulcer should be done only for definite indications, such as organic pyloric obstruction, perforation or serious hemorrhage. Foci of infection should be thoroughly removed. Prolonged medical observation and treatment after operation are essential. These things are especially important if the patient has had a partial gastrectomy for gastrojejunal ulcer, since a recurrent gastrojejunal ulcer is nothing short of a major catastrophe.

REFERENCES

1. Balfour, D. C. The occurrence and management of gastrojejunal ulcer. *Ann. Surg.*, p. 271 (Aug.) 1926.
2. Balfour, D. C. Recurring ulcers following partial gastrectomy. *Ann. Surg.*, p. 548 (Sept.) 1928.
3. Balfour, D. C. Results of gastroenterostomy for ulcer of duodenum and stomach. *Ann. Surg.*, 92: 558–562 (Oct.) 1930.
4. Beckermann. Quoted by Eusterman, G. B. Discussion to papers on physiologic studies subsequent to gastric resection for ulcer. *Proc. Staff Meet. Mayo Clin.*, 9: 507 (Aug. 22) 1934.
5. Birgfeld, E. *Arch. f. klin. Chir.*, 137: 568 1925. (Quoted by Hurst, A. F., and Stewart, M. J. Jejunal and gastrojejunal ulcers. *Lancet*, 2: 742, 1928.
6. Camp, J. D. Further observations on the direct roentgenologic signs of gastrojejunal and jejunal ulcer. *Radiology*, 15: 274, 1930.
7. Comfort, M. W. Effect of partial gastrectomy on secretory capacity of the stomach. *Proc. Staff Meet. Mayo Clin.*, 9: 500 (Aug. 22) 1934.
8. Emery, E. S., and Monroe, R. T. Peptic ulcer: nature and treatment based on a study of 1435 cases. *Arch. Int. Med.*, 55: 271 (Feb.) 1935.
9. Emery, E. S. The cause of faulty digestion after removal of the stomach. Presented at the annual meeting of the American Gastroenterological Association, Atlantic City, June 11, 1935.
10. Eusterman, G. B. A clinical study of 83 gastrojejunal ulcers; diagnosis verified at operation. *Minnesota Med.*, 3: 517–524, 1920.

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A LOWERED DEATH RATE FOR ACUTE APPENDICITIS

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IN the Middlesex Hospital of Connecticut there were recorded in the twelve years ending September 30, 1934, 1275 cases of acute appendicitis with a death rate of 2.8 per cent plus. In practically all cases operation was performed.

Although a series of 1275 cases is not conclusively large, the low death rate seems worthy of inquiry. In hospitals of the grade of the Massachusetts General Hospital and the New Haven Hospital the death rate, during this period, has been around 4 per cent for acute appendicitis.

In the Middlesex Hospital the only noteworthy change in operative organization and technique during recent years was the substituting of spinal anesthesia for general anesthesia in the year 1928. Spinal anesthesia rapidly gained in favor with us at that time, and during the five years ending September 30, 1934 was used almost exclusively, even usually for the aged, and for many children.

It was suggested that our death rate for the former six years under general anesthesia be compared with the death rate under spinal anesthesia for the last six years. This comparison was made for acute appendicitis. For the former six years the death rate for acute appendicitis was found to be 4.3 per cent plus, for the last six years 1.9 per cent plus. We feel that cutting our death rate in half has some significance even among the small number of 1275 cases.

Theoretically spinal anesthesia should reduce the death rate from acute appendicitis for the reason that in advanced cases where an infection has progressed through the serosa of the appendix, by rupture or extension, the protection of the patient lies wholly in the peritoneal adhesions that form about the infected area. Removal of the appendix in cases of extraserosal extension of the appendiceal infection does not save the patient's life, in fact does not aid in saving the patient's life. Only the gluing together of the hollow viscera, omentum, mesentery and abdominal parietes around the area of infection limits the possible extension of peritonitis once it has started.

When the abdominal wall is incised under spinal anesthesia, the loops of intestine lie quiet in contraction. The vigorous intestinal motility often seen under general anesthesia is absent. The struggling and vomiting from general anesthesia during induction and during return to consciousness, often unavoidable, cause a commotion in the abdominal cavity necessarily destructive to delicate, newly formed adhesions, and favoring most effectively and probably most disastrously an extension of the potential peritonitis over a larger area.

In cases where an infection has advanced through the appendiceal serosa, Nature's last lines of defense are threatened and damaged less by spinal than by general anesthesia. It seems plain that spinal anesthesia favors the defense reaction of the peritoneum enough to reduce in some degree the death rate of acute appendicitis.

We believe that our fortunate experience with spinal anesthesia in cases of acute appendicitis points our way to a further reduction in the death rate of this disease.

The next change to be made in our treatment of acute appendicitis would logically be to eliminate the nausea and vomiting

that often accompany spinal anesthesia. The adhesion-destroying effect of the nausea and vomiting of spinal anesthesia occurs in a disappointingly large percentage of cases. The new basal anesthetics require the supplement often of a general anesthetic, and therefore the combined basal and general anesthetics cannot be expected to do away with all nausea and vomiting.

Until we come upon a non-emetic anesthetic, general or spinal, or whatever the nature, until that day, local anesthesia seems to be our only resource to enable us to explore the abdominal cavity harmlessly. And under local anesthesia it is very possible to perform a laparotomy, and easily, and often an appendectomy, if one is willing to patiently take time to use enough novocaine in the sensitive parietal peritoneum and in the mesentery, and without tugging upon the latter organ.

Some Englishmen have for several years done laparotomies upon children with local anesthesia aided by sedatives and with the help of especially trained nurses to support the morale of these small patients. Avertin with local anesthesia gives great promise.

Another step toward the reduction of the death rate of acute appendicitis will be a "beating time" step, and will consist in letting severely alone more appendices in cases where an infection has progressed through the appendiceal serosa. The removal of a gangrenous appendix requires the placing of ligatures in healthy tissues proximal to the inflamed tissues of appendix, cecum or meso-appendix. This can be done only by breaking down newly formed adhesions, if they exist.

In 86 per cent of the fatal cases in our series the appendices were removed. And in 86 per cent of these fatal cases the cause of death is recorded as acute appendicitis or some abdominal complication of this disease. In only 23 per cent plus are lung, heart and kidney lesions mentioned as complications, and it is to be remembered that the surgeon is sorely tempted to stress such complications in his records.

Removal of the appendices certainly did not save life in this 86 per cent of our deaths. In the future it would surely be a legitimate experiment for us to allow a series of such seriously ill patients to retain their appendices in anticipation of interval appendectomies.

The plea for delayed operation in advanced cases is supported by historical argument. Before the term appendicitis appeared in vital statistics in 1892 the term peritonitis was used ignorantly to indicate the cause of death from rupture of peptic ulcer, acute pancreatitis, diverticulitis, intestinal obstruction, and occasionally, doubtless, to indicate the cause of death from obscure cases of pneumonia, typhoid fever, ectopic pregnancy and other diseases and conditions, besides appendicitis.

Peritonitis during the seventeen years 1876 to 1892 inclusive, previous to the appearance of the term appendicitis in vital statistics, had a death rate around 15 per 100,000 of population. The combined death rate from the several diseases just mentioned other than appendicitis is today more than 12 per 100,000 of population. This death rate subtracted from the old time death rate from peritonitis must leave the approximate death rate from appendicitis in those old days, unless we assume that today appendicitis has a greatly increased prevalence. Making every possible allowance for such increase and for changes of all kinds during the last fifty years, we face the inevitable conclusion that acute appendicitis treated medically of old was no more fatal than acute appendicitis treated surgically today with its present approximate death rate of 15 per 100,000 of population.

These historical data should have weight in encouraging the surgeon to delay operation for overlooked, neglected cases of acute appendicitis. When some surgeon shall have the courage to treat a large series of such advanced cases with delayed operation, he will probably be able to

report an astonishingly low death rate for acute appendicitis.

The commercialism of acute appendicitis is doubtless a factor in the death rate. The average surgeon knows too well that if he does not remove the appendix, in an advanced case, and exhibit the ruptured organ before the eyes of the family, another consultant may be called to take part in the case, whereas if the appendix is removed, although subsequently the patient dies, the family will feel that "everything has been done," and the surgeon's fee will be paid unhesitatingly.

The experience derived from our series of cases would seem to point our way, for the immediate future, along the following lines in the treatment of acute appendicitis.

Four types of cases of acute appendicitis will present themselves to us for treatment:

1. The cases seen within approximately twelve hours of the appearance of the first symptom, and presenting frank and typical signs and symptoms. In these cases we shall operate at once, preferably under spinal anesthesia, but not insistently. We shall confidently expect a death rate of less than 1 per cent among such cases.

2. A second class of cases will present a blurred picture with signs and symptoms pointing indefinitely to such lesions as ruptured peptic ulcer or one of the various abdominal emergencies including acute appendicitis. In this class of cases we must operate at once. The death rate will be according to the lesion found and the duration of the acute symptoms. If an acute appendix is found, its treatment will be that of class three.

3. Class three will consist of cases that, although a diagnosis of acute appendicitis is made at once, yet even to the surgeon of wide experience present uncertainty as to whether or not the infection is within the serosa of the appendix or has already made its way through and beyond the serosa of the appendix, and perhaps is making progress in the peritoneal cavity.

This type of case is most inconsistent and irregular in the way the lesion interprets itself. A ruptured and gangrenous appendix rolled up in a fold of omentum or cushioned over by a coil of distended intestine may be attended by slight or no tenderness and by no muscle defense, while, on the other hand, an infection contained within an appendix with its walls intact may excite a general abdominal rigidity and be the seat of most diffuse and exquisite tenderness.

A large proportion of cases of acute appendicitis present this uncertainty as to when an operation should be done. In the intraserosal case, an appendectomy will put the patient back to work in two weeks. This operation has been well called the "Pearl of Surgery." In the extraserosal case an appendectomy may break up beginning protective adhesions and pave the way for a general peritonitis.

We cannot measure preoperatively the individual peritoneum's ability to form adhesions. We only know that in some abdomens adhesions form promptly following peritoneal irritation and that in other instances adhesions do not develop early or late under similar conditions. There are probably all grades of peritoneal adhesion-forming ability. We must, therefore, for the present in every case assume that we are dealing with a peritoneum that needs the greatest inducement and the least interference in the matter of the development of adhesions about an infected appendix. In the later stages of any infection leucocytosis becomes enfeebled, and therefore the formation of peritoneal adhesions of defense, a product of leucocytosis, cannot be expected to be as effective in reconstruction as in construction. And reconstruction may not take place.

What then should be the surgical approach to this major group of cases of acute appendicitis, the group in which probably there exists the opportunity to reduce the aggregate death rate of acute appendicitis?

First, we must adopt an exploratory procedure that will, without harm to the patient, let us know whether we have in hand an intraserosal infection of an

appendix or an appendiceal infection that has progressed through the serosa of an appendix, and we must know this before we use adhesion-disturbing anesthetics and manipulation of abdominal tissues.

Such knowledge can be obtained by exploring the peritoneal cavity under a local anesthetic. Exploration will reveal various conditions that will tax our judgment to the utmost in carrying out our determination to avoid all operative measures likely to damage or weaken peritoneal defense-bulwarks. As we incise, if the general peritoneal cavity is entered, a specimen of the bacterial content should be swabbed and handed to a waiting pathologist for immediate examination. If we are found to be entering a sterile field, and if we can visualize an appendix that has intact walls, and that can undoubtedly be delivered without infecting sterile surfaces, we may then ask for any kind of additional anesthesia, and complete the appendectomy. If, on the other hand, we find ourselves in the midst of an infected general peritoneal cavity or compartment or if an abscess is encountered, a quick retreat is in order, leaving a drain as a rear guard.

If we come upon a sterile peritoneal cavity, but see an appendix extending into a mass of inflamed tissues or if we can palpate a mass of such tissues probably enveloping an appendix, our procedure should be, after satisfying ourselves as to where a forming abscess is likely to point and as to where it can be safely met on another occasion, our procedure should certainly be to call a halt, rankly unorthodox as this course may seem. The old method of tearing into edematous tissues, resulting almost always in the liberation of pus, had best be replaced by the strategy of allowing the abscess to beckon to the knife on a more mature and distinctly indicated occasion.

To "back out" at this moment will require great self restraint. We have formed a habit, during many years, of breaking up adhesions through lines of cleavage and of depending upon a suction apparatus to remove pus that wells up between our packs. We have felt secure in thus infecting only a small area of clean peritoneum, confident that the peritoneum would take care of our uncleanliness. We have been intensely concerned lest an abscess "break" into the general peritoneal cavity, but we have almost routinely recklessly groped our way into pus. It would seem inconsistent to burst in our rummaging a hundred abscesses in order to prevent Nature from making such a mistake on a rare occasion.

We must today more clearly recognize that our ancient technique always caused an infection of a non-infected peritoneal surface, and made arrangements for a general peritonitis. It may be that right here exists the possibility of reducing the death rate of acute appendicitis. At any rate after our ruthless rummaging method has been tried for so many years, with at present an increasing death rate from this disease, it is logical to try another method which is theoretically sound surgery.

The further details of the treatment of such cases are the present-day orthodox measures. The patient should be shielded from relatives in a quiet room. Apprehension should be consoled and peristalsis should be slowed down by non-emetic codeine. Morphine may be reluctantly given for pain. Nourishment and balancing fluids can be given only subcutaneously and intravenously. Nothing should be administered orally or rectally, including enemata. The nasal tube is to be used in case of nausea and vomiting. A prone or semi-prone position will be used for drainage and as a poultice. If the patient cannot tolerate this position, Fowler's position is next best.

4. The fourth class of cases of acute appendicitis consists of the near-terminal; cases of diffuse abdominal tenderness and distention, cases developing before our eyes as results, perhaps, of our treatment or coming to us from sources of neglect and ignorance. These desperately ill pa-

tients are entitled to drainage with the incision under local anesthesia and in the cecal region. There is reason for so operating, because in a few instances the pressure from distention is more death-dealing to the patient than the toxic element of the condition. And a cecostomy made a few hours postoperatively may relieve distention, and may send the patient comfortably onward toward recovery. It is impossible to tell preoperatively which patient will receive relief from a cecostomy. Moreover, establishing a point of least resistance for drainage of the peritoneal cavity may prevent a rising tide of septic fluid from reaching more distant parts, may diminish absorbtion, and may allow inflamed surfaces to fall together and to adhere together, forming barriers to spreading peritonitis.

Other details of the treatment of this fourth class are those indicated for class three. In hopeless cases with high fever great comfort to the patient is obtained by allowing large quantities of iced drinks to be ingested and returned via nasal tube.

SUMMARY

In a series of 1275 operative cases of acute appendicitis, under general anesthesia the death rate was 4.3 per cent plus and under spinal anesthesia 1.9 per cent plus.

In 86 per cent of the fatal cases the appendices were removed.

This experience points the way to a possible further reduction of the death rate of this disease.

Spinal anesthesia, less than general anesthesia, disturbs the peritoneal defense against infection. An anesthetic still less disturbing than spinal anesthesia is indicated, if a further reduction in mortality is to be obtained.

At no time during the existence of acute appendicitis should defense adhesions be disturbed.

The appendix should be removed less often. Abscesses should more often be allowed to mature and to point to a location for evacuation.

Nature left to herself will restore to health between 90 and 100 per cent of all cases of acute appendicitis. No one knows just what the percentage of fatal results would be. At present the death rate from acute appendicitis is increasing. It would be well to allow Nature to use unhampered all of her facilities for the treatment of this disease, and to perhaps learn from her wherein we fail. A more understanding cooperation with Nature should be our goal.

CONCLUSION OF DR. KING'S ARTICLE*

CONCLUSIONS

(a) Highly restricted use or complete avoidance of intravenous hypertonic solutions

(b) Free use of lumbar puncture and drainage

(c) Use of morphine with discretion and wider employment of the common hypnotics

(d) Avoidance of surgical decompression as a practice and limitation of operation to cases presenting certain clear-cut indications.

2. It is pointed out that a knowledge of recent developments in this field and the application of modern conservative methods of treatment should lead to a more efficient handling of these cases with a consequent reduction in mortality.

3. A series of 50 recent cases of head injury is reviewed in which such standardized treatment was carried out along conservative lines with a satisfactorily low mortality of 8 per cent.

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* Continued from p. 67.

LOW RESERVE KIDNEY

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In 1926, Stander and Peckham suggested a new classification of the toxemias of the latter half of pregnancy, based on a study of the clinical course, physical signs and laboratory findings of a large group of patients, and including a syndrome called "for want of a better name, 'low reserve kidney.'" The cases grouped under this heading comprised a rather definite clinical entity with the following general picture:

During the last few months of pregnancy, there may appear a moderate rise of blood pressure, usually about 150/90, and relatively small amounts of albumen in the urine, ranging from a fraction of a gram to a gram, to very slightly over one gram just before delivery. There may also be some oedema and very rarely a complaint of headache. By the end of the puerperium the blood pressure has resumed its normal level, the urine contains no albumen or only a faint trace, and any oedema that may have been present has disappeared. At no time are there any signs of a disturbed blood chemistry and the nitrogen partition of the urine is normal. In subsequent pregnancies a similar picture may recur. In other cases it may be less severe, but certainly not worse, while occasionally the patient is entirely normal. Pregnancy does not injure this type of kidney, and when we are sure that the toxemia is due to it, we need feel no alarm concerning the course of subsequent pregnancies.

The classification suggested by Stander and Peckham, including the group "low reserve kidney," was put into use on the Obstetrical Service of the Johns Hopkins Hospital in February, 1926 and has been employed since then, the diagnosis of the type of toxemia of pregnancy being made at the time of the patient's discharge from the hospital. For the past seven years this service has also included a "toxemia clinic" which has as one of its major functions the careful follow-up of all such patients after delivery and discharge. Through this means it has been possible to ascertain the remote prognosis of certain of the toxemias in terms of conditions pertaining five or more years after delivery of the abnormal pregnancy. Thus, in 1931, one of us (Peckham) demonstrated that twelve months after delivery more than 20 per cent of a series of patients with eclampsia showed definite evidence of permanent renal damage. Moreover, in 1934, the authors demonstrated that evidences of nephritis, usually arteriosclerotic in character, existed several years after delivery in 40 per cent of a group of toxemic patients, excluding cases of eclampsia and vomiting. In the following paragraphs there is presented a study of a group of patients diagnosed "low reserve kidney" and followed for at least five years subsequent to the toxemic pregnancy. This rather long period has been chosen since it was felt that this toxemic condition, being clinically mild in character, would necessitate a protracted interval before causing any signs or symptoms indicative of permanent renal damage.

A careful study of the records of the toxemia clinic revealed a group of 108 patients whose original diagnosis was pregnancy complicated by low reserve kidney, and whose course had been carefully followed for a period of five or more years following delivery. These original diagnoses had been made by the obstetrical resident at the time of discharge of the patient from the hospital and at the outset of our study it was found that many had been classified

incorrectly. Accordingly, it became necessary before preceding with the analysis to rediagnose the group more strictly in terms of the foregoing classification, when it was found that only 63 of them satisfied the criteria laid down for low reserve kidney. The remaining 45 were regrouped as follows: preeclampsia 20, nephritis 7, and unclassified 18, this last group consisting of those cases which at the time of discharge could not clearly be placed into any one of the aforementioned categories. It might be noted in passing that of the 20 patients with preeclampsia, 12 were normal at the time of this study, while 8 of them had a definite nephritis; and of the 18 unclassified toxemias 10 showed evidences of permanent renal involvement.

There remained, then, 63 patients whose corrected original diagnosis at discharge was low reserve kidney and who had been followed for a period of five years or more. At the end of this period it was found that only 31 were negative in so far as signs or symptoms of nephritis were concerned, while 32 showed evidences of definite renal involvement, in most instances arteriosclerotic in character. In view of this totally unexpected finding it became evident that the original concept of the low reserve kidney with its favorable prognosis for subsequent pregnancies either must be given up entirely or else altered in such a way as to exclude these instances of nephritis. The best method of approach to the problem seemed to be an analysis of the entire course of these patients from the time of the original toxemia to the present, dividing them into two groups depending on whether the ultimate outcome was "normal" or "nephritic." The results of this analysis will now be presented.

RACE, AGE AND PARITY

It might be stated in passing that in none of the patients in the series was there any previous history of diseases which might have contributed to the development of nephritis. Table 1 indicates first that although the toxemic condition occurred equally in the white and black races, yet the outcome in terms of permanent renal involvement is less favorable in the latter group. Moreover, it seems clear that age and parity were important factors in determining the ultimate outcome since more than four-fifths of the patients remaining normal were primiparae and under twenty-five at the time of the toxemic pregnancy, while in the nephritic group the preponderance was on the side of the multiparae and those in the older age groups. To restate this finding we may say that of a total of 40 patients under twenty-five years of age, 14 or 35 per cent later showed evidences of permanent renal involvement; while of 23 women above this age 18 or 78 per cent were found to have nephritis at the time of this study. Similarly, 12 out of 40 primiparae (30 per cent) were ultimately found abnormal, whereas only 3 of the 23 multiparae in the series (13 per cent) remained without hypertension and albuminuria.

Table 1
RACE, AGE AND PARITY

	Normal		Nephritis	
	Number	Per Cent	Number	Per Cent
Race				
White	16	57.14	12	42.86
Black	15	42.86	20	57.14
Age				
Under 25	26	83.87	14	43.75
25 and over	5	16.13	18	56.25
Parity				
Primiparae	28	90.32	12	37.50
Multiparae	3	9.68	20	62.50

BLOOD PRESSURE, ALBUMINURIA, CASTS, EDEMA AND BLOOD CHEMISTRY DURING TOXEMIC PREGNANCY

The blood pressure was, of course, moderately elevated during late pregnancy in all of the individuals in the series but no significant difference was found between

the groups subsequently normal or nephritic. The mean pressure found, based on the highest reading during pregnancy or the

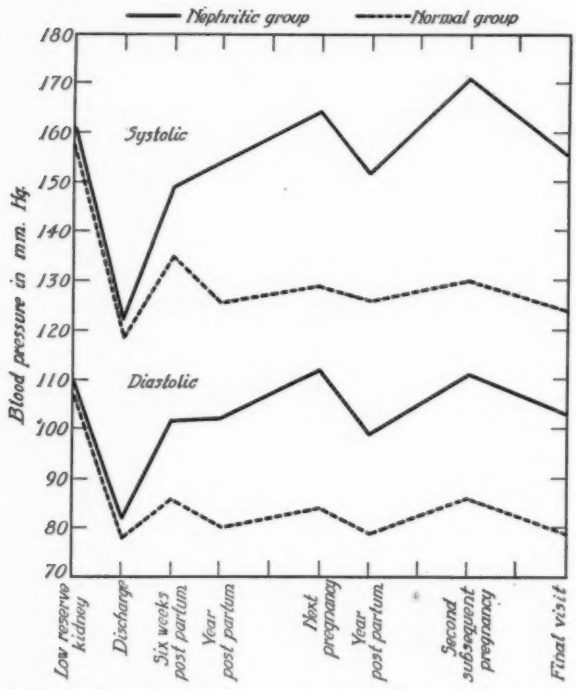

FIG. 1. Mean blood pressure readings throughout period of follow-up study in cases originally diagnosed low reserve kidney and separated according to whether ultimate outcome was normal or nephritic.

early puerperium, was 159/107 in the normal group as contrasted with 162/110 in the nephritic group. Moreover, at the time of discharge from the hospital, means of 119/78 and 121/82 were obtained for the two groups respectively. The amount of albumin present in the urine in terms of grams per liter as determined by the Esbach method, the presence or absence of casts in the urine, the blood chemistry in terms of non-protein nitrogen, uric acid, and carbon-dioxide combining power, and the amount of edema developing prior to delivery were all approximately the same whether the ultimate outcome was normal or nephritic.

DURATION OF PREGNANCY AT TIME WHEN HYPERTENSION OR ALBUMINURIA APPEARED

It is customary in this Clinic to regard the blood pressure as abnormal when the systolic reaches 140 mm. or the diastolic 90 mm. Likewise, albuminuria is diagnosed by the finding of a definite cloud when Esbach solution is added to the urine. Considering the toxemia as beginning at the time of occurrence of either hypertension or albuminuria, Table II has been compiled.

TABLE II
DURATION OF PREGNANCY AT TIME OF ONSET OF TOXEMIA

Duration	Normal		Nephritic	
To 7 lunar months.....	0		1	
7 lunar months.....	0	9.68%	4	53.12%
8 lunar months.....	3		12	
9 lunar months.....	12		8	
Term.....	16	90.32%	7	46.88%

It will be noted from Table II that in more than half (53 per cent) of the patients ultimately showing evidences of nephritis the original toxemic condition manifested itself more than four weeks before term. On the other hand, in the group of women still normal at the time of this study we found no instance of toxemia developing prior to the thirty-second week of pregnancy and 90 per cent of the cases became abnormal only after the thirty-sixth week. Moreover, in the total group of low reserve kidney cases there occurred 20 instances of hypertension or albuminuria developing before the last lunar month and of these only 3 (15 per cent) were in the normal group. This interesting difference between the normal and nephritic patients will be discussed in a subsequent paragraph.

BLOOD PRESSURE AND ALBUMINURIA SIX WEEKS AND ONE YEAR AFTER DELIVERY

TABLE III
BLOOD PRESSURE SIX WEEKS AND ONE YEAR AFTER DELIVERY

Mean Pressure	Normal	Nephritis
Six weeks after delivery.....	135/86	149/103
One year after delivery.....	126/80	154/102

It will be noted from Table III that six weeks after delivery the mean blood pres-

sure in the group of normal patients was within normal limits while in the nephritic group hypertension already existed; while one year after delivery the disparity was still more evident. However, analysis of the individual case records showed that six weeks after delivery the blood pressure was abnormally high in 30 per cent of the patients in the normal series while a half of the nephritic group showed no hypertension at this time. As a corollary to this it might be stated that one of us (Stout) has already noted a transient hypertension existing six weeks postpartum in 17 per cent of a series of patients normal in this regard throughout pregnancy, labor and the early puerperium. Moreover, at the "six weeks return" visit a trace of albumin was found in the urine more frequently in patients of the normal group, than in those later showing renal involvement. Even a year after delivery hypertension or albuminuria was to be found in a small percentage of the normal group while a similar fraction of the nephritic cases still had a normal pressure and negative urine at this time. Thus it would seem totally impossible to venture a prognosis as to ultimate outcome at the end of the puerperium, and even a year later a small degree of error exists. At the latter time, however, most of the cases may be correctly classified and in this one is aided by the presence or absence of symptoms such as headache, lumbar backache, edema, or nycturia which did not occur in any of the patients in the normal group although found in more than four-fifths of the nephritic patients.

SUBSEQUENT OBSTETRICAL COURSE

Approximately two-thirds of the total patients under consideration have been followed through one or more pregnancies subsequent to the one complicated by low reserve kidney. Table IV indicates that in each of the 22 patients in the nephritic group the subsequent pregnancies were complicated by toxemia (or, stated more accurately, nephritis), whereas the later obstretrical course was toxemia-free in 18 of 21 such women in the normal series. We have observed, then, only 3 patients with subsequent toxemic pregnancies who after five years may still be diagnosed as normal. These women have all been followed by the Clinic throughout their entire obstetrical career, and each of them has had two toxemias, termed unclassified, following the initial low reserve kidney. At the present time their blood pressures are near the abnormal line ($^{135}/_{85}$, $^{132}/_{85}$, and $^{120}/_{90}$), none has albuminuria, and 2 complain of headache and backache. It is our opinion that these patients will subsequently develop definite evidence of permanent renal involvement and that their prognosis for future pregnancies is ominous. Figure 1 shows graphically the mean blood pressure readings in those patients of the normal and nephritic groups who have been followed through subsequent pregnancies.

TABLE IV
SUBSEQUENT OBSTETRICAL COURSE

	Normal	Nephritic
Total patients	31	32
Patients with subsequent pregnancies	21	22
Subsequent pregnancies normal	18	0
Subsequent pregnancies toxemic	3	22

During the five-year follow-up period, 5 deaths have occurred in these 63 patients. One of the deaths was in the normal group and was due to a gonococcal septicemia. Of the remaining 4, 2 patients died in uremia, while tuberculous pneumonia and septicemia, respectively, accounted for the remaining fatalities, chronic nephritis being recorded in each case as a coincidental autopsy finding. Moreover, 10 patients in the nephritic group have already had their childbearing careers terminated either by hysterectomy or tubal excision.

DISCUSSION

In order to test the validity of the concept of the low reserve kidney as proposed by Stander and Peckham in 1926 in

their "Classification of the Toxemias of the Latter Half of Pregnancy," it was proposed to investigate a group of such patients who had been observed at frequent intervals for a period of five or more years subsequent to the original toxemic pregnancy. From the case records of the toxemia clinic a total of 108 such patients was found. The diagnosis of low reserve kidney had been made in each instance by the obstetrical resident and careful study of the records revealed that in only 63 instances were the criteria proposed for the low reserve kidney satisfied, the remainder being cases of nephritis, preeclampsia and unclassified toxemia. This suggests the necessity of extreme care in the diagnosis of any toxemia of pregnancy because of the influence of such a diagnosis upon the prognosis to be given for a future pregnancy and since errors in prognosis may be hazardous to the future existence of the patient. There were, then, 63 patients who had developed a mild toxemia in the second half of pregnancy which had subsided promptly after delivery so that on discharge from the hospital the blood pressure in each instance was normal and the urine albumin free. It was found that at the end of five years only a half of these women were normal while an equal number showed definite evidences of chronic nephritis, in most cases arteriosclerotic in character. The original concept of the low reserve kidney had carried with it a favorable prognosis for subsequent pregnancies but this became no longer tenable in view of a 50 per cent incidence of subsequent nephritis. Accordingly, it seemed necessary either to discard the entity entirely or amend it so as to exclude those cases later evidencing permanent renal involvement and for this reason the case records were minutely examined in order to detect differences between those patients ultimately normal or nephritic.

It was found that young women and primiparae predominated in the normal group, while multiparae and those in the older periods of child-bearing made up the majority of the nephritic cases. The past history was valueless in revealing disease conditions which might have rendered suspect the later development of nephritis. The course of the toxemic condition in terms of blood pressure and albuminuria (both during pregnancy and the early puerperium), casts, edema, and blood chemistry (non-protein nitrogen, uric acid, and carbon-dioxide combining power), was almost exactly similar in the normal and nephritic groups. However, investigation of the duration of pregnancy at the time of onset of the toxemia as evidenced by the development of hypertension and albuminuria showed an important disparity between the two groups, since only 15 per cent of those patients who had developed these signs prior to the ninth month of pregnancy were in the normal series. Moreover, more than 90 per cent of the group normal after five years had shown toxemic signs only during the last month of pregnancy, while in over half of the nephritic series hypertension and albuminuria had developed prior to this time. Most of the patients were observed six weeks postpartum, at which time a third of the normal group still had hypertension and albuminuria as did a half of the nephritic group. Even a year after delivery the ultimate prognosis was not always clear, although by this time the percentage of error was only 10 to 15 per cent. Two-thirds of the patients analyzed have been followed through one or more subsequent pregnancies, and the course of these in terms of development of repeat toxemias seemed extremely important. Pregnancy complicated by toxemia was observed in all of the 22 women in the nephritic group, while the course of gestation was normal in 18 out of 21 patients in the normal series. Only 3 of the patients who are still diagnosed normal after the five-year period have had a repetition of their toxemia in subsequent pregnancies, and all 3 of them at the present time have suspiciously high diastolic pressures and also symptoms which lead us to believe that they will eventually develop definite evidences of chronic nephritis.

From the foregoing analysis and discussion the authors wish to propose the following revised concept of the low reserve kidney. The low reserve kidney is a clinically mild toxemia of pregnancy, associated with a moderate degree of hypertension, rarely exceeding 160/110, and a small amount of albuminuria, not more than 2 grams per liter. Edema and headache are not conspicuous. The condition is observed only in primiparae and especially in those of the younger age groups. It rarely manifests itself prior to the last month of pregnancy and usually clears up entirely in the early puerperium, although occasionally hypertension will persist for some time. In subsequent pregnancies the course is toxemia free.

It is realized that this revised concept will limit considerably the number of cases to be classified low reserve kidney. Moreover, there will exist an increased number of toxemias which will have to be tentatively diagnosed at their discharge from the hospital as "unclassified" or "atypical," since they cannot be exactly placed at this time in the groups preeclampsia, eclampsia, low reserve kidney or nephritis. Such a procedure, however, seems to be the more intelligent since one of the major functions of toxemia diagnosis is a prognosis for subsequent pregnancies, and errors in such a prognosis are dangerous to the patient. It is believed that in doubtful cases it is well to defer the ultimate diagnosis for at least a year after delivery and occasionally even a longer interval may be necessary.

It may be plausibly argued that the revised concept of low reserve kidney is essentially that of a mild preeclampsia and in view of our present imperfect knowledge of the etiology of the toxemias of pregnancy the authors cannot definitely refute such a statement. However, true preeclampsia is usually an acute and fulminating condition associated with marked signs and symptoms, the immediate forerunner of eclampsia; while the condition we have described differs from it materially in its clinical mildness and paucity of symptoms.

Finally, it is our belief that despite the character of the signs and symptoms coincident to any toxemia during pregnancy, or the rapidity with which the patient becomes apparently normal during the early puerperium, it is unwise to offer an immediate prognosis for a subsequent pregnancy. In order to provide a patient with the greatest margin of safety it seems best to advise against another pregnancy for at least one and preferably two years, when, following repeated observation and follow-up study, including careful examinations of the eye grounds, a prognosis may be given which would keep at a minimum errors resulting in a pregnancy complicated by a repeat toxemia or nephritis.

The authors take pleasure in stating that the senior author of the original low reserve kidney paper, Dr. H. J. Stander, has examined the above data and is in agreement with their conclusions.

SUMMARY

As the result of a five year follow-up study of a series of toxemic patients originally diagnosed as having "low reserve kidney," it has been found necessary to alter the concept of this condition as proposed by Stander and Peckham in 1926. It is our present opinion that the condition is limited to primiparae, and that it manifests itself, usually not before the last month of gestation, by the presence of a moderate degree of hypertension and a small amount of albumin in the urine. Ordinarily it clears up rapidly in the early puerperium and does not recur with subsequent pregnancies. Clinically the course is mild and does not resemble true preeclampsia.

REFERENCES

1. Stander, H. J., and Peckham, C. H. A classification of the toxemias of the latter half of pregnancy. *Am. J. Obst. & Gynec.*, 11: 583, 1926.
2. Peckham, C. H. Chronic nephritis following eclampsia. *Johns Hopkins Hosp. Bull.*, 45: 176, 1929.
3. Peckham, C. H., and Stout, M. L. A study of the late effects of the toxemias of pregnancy (excluding vomiting and eclampsia). *Johns Hopkins Hosp. Bull.*, 49: 225, 1931.
4. Stout, M. L. Hypertension six weeks postpartum in apparently normal patients. *Am. J. Obst. & Gynec.*, 27: 730, 1934.

TRICHOMONAS INFESTATION OF THE PROSTATE GLAND*

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FOR the past two years it has been the writer's contention that the trichomonas could be cultured successfully from the prostates of husbands whose wives were suffering from Trichomonas vaginalis. The writer was able to demonstrate the Trichomonas vaginalis in a direct prostatic smear two years ago, but was unable to secure suitable culture medium to grow the organism.

Largely through the generosity of Dr. A. Packcanian, bacteriologist, and the cooperation of Mrs. L. H. Owens, a suitable medium containing egg yolk, charcoal, starch and blood serum has successfully grown the trichomonas for a period of four to six days in the incubator. Through permission of the Gynecology Department of the New York Post-Graduate Medical School and Hospital, the writer secured the names of nine positive trichomonas patients, and with the help of Dr. Ralph A. Pattyson, five of these infected patients' husbands were persuaded to come to the urological clinic to be routinely examined for evidence of trichomonas infestation of their prostates. None of these presented subjective symptoms.

The procedure of examination consisted of, first, smearing whatever secretion there was from the meatus, followed by culture of the meatal contents. The meatus and the anterior urethra were then irrigated with metaphen 1:8000. The patient was then asked to void a small amount of urine, approximately 10 c.c., which was then cultured, following which he was catheterized, and the urine so obtained cultured. Upon withdrawal of the catheter the urethra was again irrigated with methane 1:8000, the prostate was then massaged, and direct smear and culture of its fluid taken.

Before instigating treatment, three such procedures were carried out on each of the five husbands examined.

It is of interest to note that in reviewing the literature, the trichomonas as it was discovered in the male was always associated with a urethral discharge, or better, confused with a urethral discharge. The importance of this confusion is manifest when compared with findings in the husbands examined, none of whom presented a single sign or symptom of urethral irritation.

FINDINGS

Positive female cases	9
Husbands of these patients examined	5
Positive prostatic fluids secured	4
Two or more successive positive prostatic cultures	3
Positive direct smear from meatus	1
Positive direct smear from prostate	4
Positive catheterized urine cultures	0
Positive smear from voided urine	1
Response to treatment	3
Failure to return for treatment	1

TREATMENT

The treatment consisted of irrigating the posterior urethra with metaphen 1:8000 and the injection of electargol 3 c.c. into the lateral lobes of the prostate. This was accomplished through the McCarthy

* From the New York Post-Graduate Hospital and Medical School, under the supervision of Prof. Joseph F. McCarthy, Director-in-Chief of the Urological Department. This paper was made possible through the generosity and cooperation of the Gynecological Department of this institution.

Read before the American Urological Association at the Academy of Medicine, New York City.

pan-endoscope No. 22 or 24, and a specially devised intraprostatic needle.

One treatment was all that appeared necessary, since repeated cultures over a period of two or more months failed to reveal the presence of the trichomonas.

CASE REPORTS

Case I. R. G. No itching about meatus. Intercourse once each week. Does not wash after intercourse. Uses no contraceptives.

Physical Examination. Genitalia negative. Prostate slightly enlarged bilaterally.

Wife. A. G. Gynecological Clinic April 10, 1934. Positive smear for Trichomonas vaginalis. Treated with sodium bicarbonate and sodium perborate. Remained negative until May 15, 1934 when again reported positive smear. Treatment resulted in negative smear until June 15, 1934 when again positive; negative and again positive August 14, 1934. Husband treated August 16, 1934. Wife has remained symptom-free and repeated smear has been found negative. Patient discharged.

Case II. F. F. Intercourse twice a week. Occasionally washes after intercourse. Uses no contraceptives.

Physical Examination. Negative.

Wife. M. F. First treated in Gynecological Clinic June 7, 1934. Positive smear at first examination. Treated weekly. Negative smear June 23, 1934. Reported again positive August 10, 1934. Husband treated August 18, 1934. No symptoms since in wife. Smear still negative September 27, 1934.

Case III. B. R., aged fifty. Married twenty-three years. Intercourse once each week. Washes usually after intercourse.

Physical Examination. Genitalia negative. Prostate moderately enlarged.

Wife. Repeated smears have been negative. Patient has signs of trichomonas infection and has been treated accordingly. Now has slight itching but no burning. Has an endocervicitis.

Case IV. G. R., aged forty-three. Married eighteen years. Wife aged forty-three. Children aged six and seventeen years. Intercourse once each week. Does not always wash after intercourse. No itching or burning.

Physical Examination. Small meatus, otherwise negative.

Wife. Positive smear September 15, 1934. Weekly treatment instigated and still positive smear October 9, 1934. Husband treated October 14, 1934. No vaginal symptoms or urinary symptoms now. Smear still negative October 27, 1934.

Case V. G. S., aged thirty-five. Married eleven years. No children. No contraceptives. Intercourse once each week. Always washes after intercourse. Patient has been told sperm is dead.

Physical Examination. Sperm immobile, tails broken off. Small meatus. On right enlarged head of epididymis. (There is a history of a painless swelling of right testicle four years ago which gradually subsided.) Smear and culture negative.

Wife. C. S. On May 11, 1934 positive smear for Trichomonas vaginalis. Treated weekly and secured negative smear June 28, 1934. On July 26, 1934 smear again positive. September 29, 1934, after weekly treatments, smear again negative.

CONCLUSIONS

1. The Trichomonas vaginalis does infest the prostate, probably in a higher percentage of cases than hitherto suspected.
2. It has been confused with other non-specific discharges of the male urethra.
3. The male infested with trichomonas usually presents no symptoms or physical sign.
4. The male undoubtedly harbors the organism in his prostate and may repeatedly reinfest a female through intercourse.
5. The technique of the culture, which has heretofore been difficult, is rendered easier by the culture medium devised by Dr. Packcanian.

STRUCTURE AND PHYSIOLOGY OF THE TRICHOMONAS

Structure. In the past there has been much classification and nomenclature but little objective study.

The trichomonas belongs to the flagellate infusoria. The average trichomonas is 15 to 26 mm. in length and 7 to 16 mm. in width.

The commonest form is piriform, although they may assume elliptical or ovoid forms. One end is definitely rounded, the other broad; the latter is sometimes

in front, sometimes behind. The outline of the periphery of the organism is sharp, while the inner structure is usually finely granular. Frequently highly refractory granules in the cytoplasm and what appear to be small vacuoles are seen. If the organism is grown on media containing starch, many starch granules may be seen inside the sharply outlined periphery or cuticle. In unstained specimens the nucleus cannot be seen; when stained it appears always in the anterior portion and generally lies obliquely. Its size is approximately one-third the length of the organism itself.

Fig. 1. Pure culture of Trichomonas vaginalis.

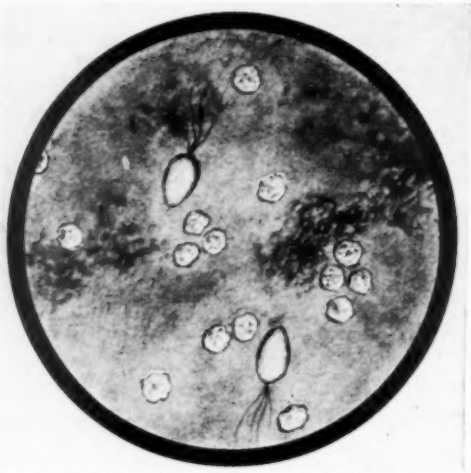

Fig. 2. High dry power of Trichomonas vaginalis in specimen of prostatic fluid.

On the anterior end of the organism are the flagella. Their exact number is disputed, varying from one to four. The writer has noticed more often three but occasionally four. They appear to arise from a common pedicle at times but generally are seen to arise from the body itself. Their length varies from one-half to twice the length of the body. Their diameters appear nearly the same at all parts of the flagella. They have fairly clear outlines.

On several occasions the writer has noticed a sort of tail at the posterior end of the organism. It appears to be a transparent mass very much resembling a pseudopodium. It is of interest that some specimens for culture may be entirely free of this posterior projection while another culture may reveal only organisms with the so-called pseudopodial structure.

On examination of some specimens there appears on one side of the organism an "undulating membrane." The membrane appears to extend at times from two-thirds to one-half the length of the organism. Its origin is difficult to make out, but apparently may arise from either side of the organism, and on the side of its origin there seems to be a gradual thinning out of that side of the parasite. Because the outer edge of the membrane is longer than its insertion the outer edge is given a scalloped or fluted appearance. The writer has not been able to stain the membrane satisfactorily.

Physiology of the Trichomonas: Motion of the organism is accomplished in a number of ways. The most common is by contraction of a part of the body resulting in a change in form. Another method of locomotion is by the forward movement of lobes together with the contractions just mentioned so that an ameboid motion is simulated.

Another function exhibited by the trichomonas is the formation of pseudopods. This apparently can occur in any part of the body. They occasionally attack a leucocyte and remain anchored while at the same time the body of the parasite undergoes active changes of position so that the undulating membrane may at intermittent

intervals appear at the front of the organism. Starch granules have been seen to be engulfed by these pseudopods and

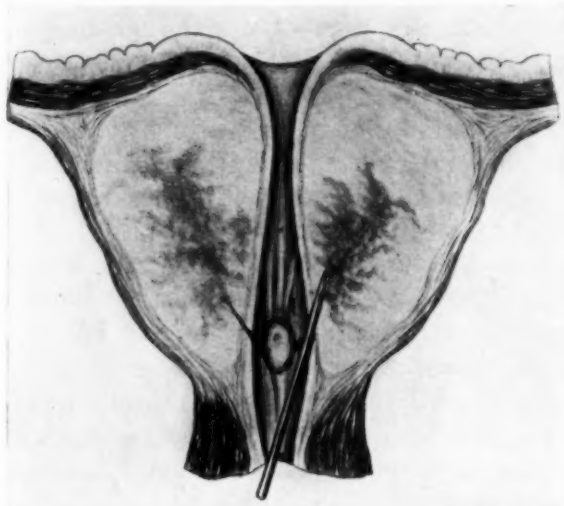

Fig. 3. Method and location of intraprostatic injection.

would, therefore, seem to play an important part in the nutrition of the parasite.

The flagella exhibit usually a whip-like motion, but may also assume one of a spiral nature. The motion is generally directly forward. At times one flagellum may be seen to bend downwards to one side of the organism. The motion is of such a nature as to create a current toward the insertion of the flagella on the anterior end of the organism.

The undulating membrane, because of the greater length of its outer membrane, has a motion of a waving character while at other times the motion is definitely spiral. This membrane, likewise, produces a current which runs to the anterior end of the organism.

The trichomonas is extremely sensitive to external conditions. We have been unable to keep cultures in the starch, charcoal, and egg yolk media alive for over five to six days. The parasite seems to thrive in starch but each succeeding day becomes progressively smaller and finally fades out entirely. If kept as collected, i.e., in prostatic fluid, it remains viable for only six to eight hours even in an incubator. Cold causes the organism to lose its motion, but if the slide is warmed it will regain its motion. Motion is active at 70°F. and most active at 90°F. and ceases altogether

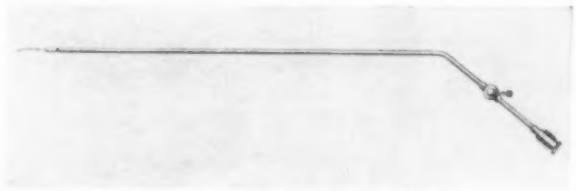

Fig. 4. Intraprostatic needle.

at 118°F. The addition of dilute alkalies does not stimulate the organism and strong alkalies are distinctly injurious. All chemicals such as mild antiseptics kill the parasite readily.

Review of the Literature on Trichomonas in the Male

Minura, in 1893, found trichomonas in the freshly voided urine of a fifty-two year old man, but examination of a catheterized specimen was negative. With all due respect, however, Minura examined the bodies of the organisms with inadequate instruments and his description is imperfect for that reason.

Marchand, in 1894, was probably the first to find the trichomonas, in the bladder of a man of sixty years who had suffered seventeen years from fistula in the perineum. This abscess later ruptured into the bladder. Immediately afterward the patient's general condition improved, but the urine remained turbid and it was acid. Microscopic examination revealed epithelial cells, erythrocytes, hyaline casts, bacteria and flagellates (trichomonas).

In 1896 Dock reported flagellates in the freshly voided urine of a twenty-seven year old student. This man gave a history of urgency, pain on urination, and occasional hematuria. There was occasional pain in the left lumbar region and the right groin, with pain radiation to the urethra.

Katsunuma in 1924 reported the organism in the urine of a three year old boy. The examiner found a red and swollen edematous prepuce. The mode of transmission was thought to be from the fingers of a woman.

In 1925, Dastidar, after examining 1000 specimens of urine, reported trichomonads in the urines of three males and one female.

Fig. 5. Composite diagram of single organism of Trichomonas vaginalis.

The only symptoms in these patients were a mild urethritis and occasional burning on urination.

In 1927, Čapek reported 2 cases of trichomonas urethritis in the male. One patient complained of a purulent discharge in which trichomonas was discovered. The wife of the patient was found to have similar organisms in her vagina and urethra. Čapek's other patient had a similar discharge, but in addition, he had an acute epididymitis.

Riba and Perry, in 1929, added 2 cases to the literature; one that of a man of twenty-eight who complained of urethral discharge and nocturia, especially following intercourse. Physical examination revealed a prostate of approximately normal size but slightly irregular. Direct smear of the prostatic fluid revealed the presence of trichomonas. Their other case was that of a colored man of sixty-one, who complained of frequency and nocturia, with slight burning. A week later he developed a purulent discharge. The prostatic secretion contained many motile trichomonas together with a large number of pus cells.

Grimn in 1930 reported 5 cases of trichomonas urethritis in the male. His first case was that of a married man of thirty-four, who had a urethral discharge which had been treated, without improvement. Direct smear showed many trichomonads. Examination of the prostatic fluid was negative. Trichomonads were found in the vagina of his wife.

The second case was that of a single young man of twenty-five years, who had had coitus four months before. He first noticed a urethral discharge of two weeks' standing which was mucoid and which later became purulent. There was slight burning on urination. Trichomonas was demonstrated on direct smear.

The third case was that of a single man forty-two years of age. He had had gonorrhea three years previously. He had been treated for three months for a nonspecific urethritis.

The fourth case was that of a single man, twenty-five years of age, who had had gonorrheal urethritis eighteen months previously. For the past month he complained of a burning at the meatus with some purulent discharge.

The fifth case was that of an unmarried man twenty-nine years old, who had had gonorrhea one year before. He had had intercourse three weeks prior to a purulent urethral discharge, together with burning during and after urination. Trichomonas was demonstrated on direct smear.

Rosenthal, in 1931, reported one case, that of a man of seventy-two who complained of painful micturition together with suprapubic pain and scanty urine. The examination of the urine revealed many motile trichomonads. On rectal examination the prostate was found to be only moderately enlarged and without tenderness. The prostatic secretion was negative for trichomonads.

Jenkins, in 1932, reported the case of a man of twenty-one years complaining of urethral discharge and burning on urination

for the previous eight weeks. He had had nocturia eight to ten times for five days. He denied gonorrhea. Physical examination revealed a markedly long and swollen prepuce, which could not be retracted over the glans. Rectal examination revealed a moderately enlarged and tender prostate. The seminal vesicles were not palpated. The fresh urethral discharge revealed many pus cells and motile trichomonads. The prostatic secretion showed 25 to 30 pus cells per high power field, some in clumps, motile spermatozoa in small numbers and motile trichomonads.

Stuhler in 1933 reported the case of a man of fifty-two who came to the clinic complaining of low back pain and pain in the hips. The urine was negative except for an occasional pus cell. He complained of frequency during the day and nocturia twice. He had had gonorrhea twenty years previously. The expressed prostatic secretion contained many Trichomonas vaginalis.

REFERENCES

1. Minura, K. Trichomonas vaginalis im frischgelassenen Urin eines Mannes. *Centralbl. f. Bakteriol.*, 16: 67, 1894.
2. Marchand, F. Ueber das Vorkommen von Trichomonas im Harne eines Mannes, nebst Bemerkungen ueber Trichomonas vaginalis. *Centralbl. f. Bakteriol.*, 15: 704, 1894.
3. Dock, G. Trichomonas as a parasite of man. *A. J. M. Sc.*, 111: 4, 1896.
4. Dock, G. Flagellate protozoa in the freshly passed urine of a man. *Med. News*, 2: 690, 1894.
5. Dastidar, S. K. G. Trichomonas infection in the urine. *Indian Med. Gaz.*, 60: 160 (April), 1925.
6. Čapek, A. Die Flagellaten-Urethritis des Mannes. *Med. Klin.*, 23: 1535, 1927.
7. Riba, L. W. Trichomonas urethritis. *J. A. M. A.*, 96: 2100, 1931.
8. Riba, L. W., and Perry, E. Trichomonas prostatovesiculitis. *J. Urol.*, 22: 563, 1929.
9. Grimm, O. Frequency of Trichomonas vaginalis urethritis in man. *Dermat. Ztschr.*, 59: 314, 1930.
10. Rosenthal, D. B. Urinary infection with Trichomonas vaginalis in the male. *Med. J. Australia*, 1: 782, 1931.
11. Jenkins, P. K. Urethritis due to trichomonas. *New England J. M.*, 208: 687, 1933.
12. Stuhler, L. G. Trichomonas vaginalis infestation of the prostate gland. *Proc. Staff Meet. Mayo Clin.*, 8: 221, 1933.
13. Davis, C. H., and Colwell, C. Trichomonas vaginalis. *J. A. M. A.*, 92: 306, 1929.

CONCLUSION OF DR. MUSCHAT'S ARTICLE*

The following forms are observed. 1. Status in normal: Both mechanisms are in normal balance, urination is normal; 2. Incontinence simulated by severe frequency of urination, due to hypertonus of the detrusor with a normal sphincter, as seen in contracted bladders; 3. Incontinence due to injury of the sphincter with a normal detrusor, as seen after perineal operations; 4. Incontinence due to hypertonicity of the detrusor and relaxation of the sphincter, as seen in a neurogenic bladder of hypertonic type; 5. Incontinence simulated by overflow, due to a hypotonic detrusor and spastic sphincter, as seen in a neurogenic bladder of hypotonic type; 6. Incontinence due to hypertrophy of the detrusor and relaxed sphincter, as seen after suprapubic prostatectomy.

*Continued from p. 104.

GRAPHIC ILLUSTRATION OF

VARIOUS FORMS OF INCONTINENCE*

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WHILE discussing various forms of incontinence one becomes aware of the difficulty in trying to visualize the actual mechanism of this disturbance of the bladder. This problem can be illustrated graphically, thus avoiding complicated discussions.

There are two motive factors concerned in the problem of incontinence, the detrusor and the sphincter of the bladder. The disturbed interplay of these two mechanisms, the increased tonus of one or the lowered tonus of the other, produce incontinence.

If one draws two parallel lines, the upper representing the detrusor (D) and the lower the sphincter (S) and admitting that a particular position of both on the graph represents their normal tonus, any deviation from the normal upwards will indicate hypertonus, while deviation downwards will indicate hypotonus.

FIG. 1.

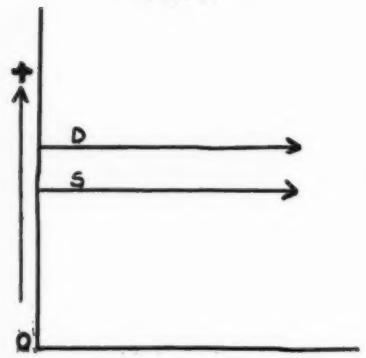

FIG. 2.

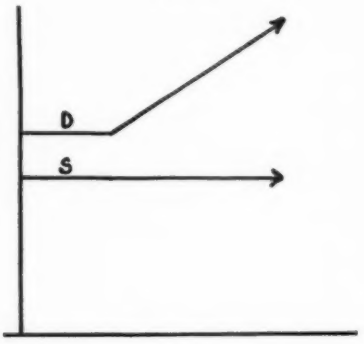

FIG. 3.

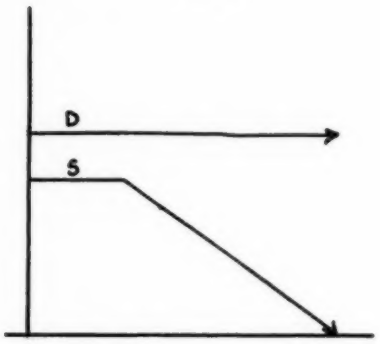

FIG. 4.

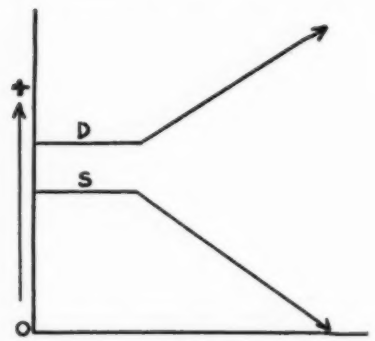

FIG. 5.

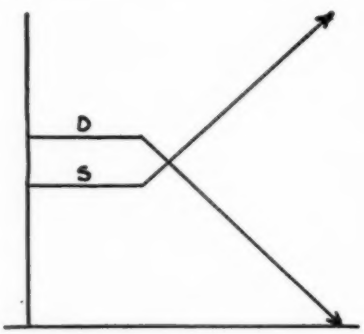

FIG. 6.

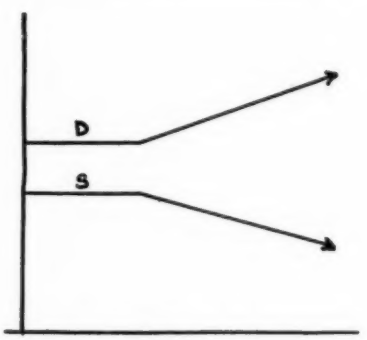

FIG. 1. Normal. D, detrusor and S, sphincter. Both these muscles are represented as stationary with a positive tonus. Balanced evacuation. Deviation upwards will indicate hypertonus while downwards will mean hypotonus.

FIG. 2. Hypertonic detrusor and normal sphincter, causing great frequency which can simulate incontinence.

FIG. 3. Normal detrusor and relaxed sphincter, as seen after perineal operations, causing partial or complete incontinence.

FIG. 4. Hypertonic detrusor and relaxed sphincter, as seen in a neurogenic bladder of hypertonic type, resulting in incontinence.

FIG. 5. Hypotonic detrusor and spastic sphincter, as seen in a neurogenic bladder of hypotonic type, resulting in retention with overflow incontinence.

FIG. 6. Hypertrophy of detrusor and relaxed sphincter as seen after suprapubic prostatectomy, causing partial incontinence.

[Concluded on p. 103.]

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ENDOMETRIOMA ON THE LIGAMENTUM ROTUNDUM UTERI*

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St. Joseph's Hospital

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DURING the last two decades, endometriosis has been the subject of much clinical research by the gynecologist, and a volume of literature has accumulated. The surgeon, however, has relegated this important clinical and pathological entity to a subordinate rôle. But he is definitely concerned when the lesion invades structures other than the female organs of generation. In the literature there are some 200 cases of invasion of the rectum,[1] bladder,[2] umbilicus,[3] laparotomy scars[4] and the inguinal region. Endometrial tissue tumefactions have never been reported in the male, nor have they been observed clinically in any place other than the abdominal cavity and groin.

Endometriosis must be considered in the differential diagnosis of certain surgical lesions and all clinicians should be definitely conscious of its clinical characteristics. With this in mind, we present the following case which demonstrates several points of both clinical and scientific interest:

Mrs. A. M., No. 43164 plus, thirty-five years old, separated from her husband, housewife, applied at the Northwestern University Clinics for treatment on August 25, 1931.

Her history was as follows: Two years ago she noticed soreness across the lower abdomen on arising in the morning, which would last about two hours. About one year ago she noticed a swelling in the left groin which became sore. At this time the pain in the lower abdomen disappeared. In the last three months the swelling in the groin has increased in size. It is larger and more tender during the menses, but some tenderness is noticed in the intermenstrual period. At this time she was seen by Dr. Fredrick Christopher, who made a diagnosis of a left inguinal endometriosis, and advised surgery. It was refused.

She returned to the Dispensary on June 17, 1932, presenting the same symptoms. Rectal and proctoscopic examination did not disclose any abnormalities. No hernia could be made out. She was referred to the Gynecological Clinic.

On June 20, 1932 she was seen in the Gynecological Department. The menstrual history was that catamenia had begun at ten years, and lasted two days with a moderate flow. The periods were perfectly regular. She had had one normal delivery, and one miscarriage at three months in 1929. During both of the gestations no pain was noticed in the groin at the place where the tumor mass lies. On vaginal examination she was found to have a moderate cystocele and rectocele, also a slight retrodisplacement of the uterus, and a cervical laceration and erosion. No definite diagnosis was made, and she was treated symptomatically.

She returned again in May, 1932, and the question of femoral hernia was discussed, but no femoral hernia was found. The complaints were exactly the same, swelling and pain in the left groin during the menstrual period.

She did not return again until June, 1934, at which time the same history was obtained, and the findings were identical. The impression at this time was that either a neoplasm or an osteomyelitis of the pubis was present. *X*-ray examination was carried out and no significant changes were found in the pubic bone other than some halisteresis on the left side. A diagnosis of a low grade infection probably of the pubic bone or periosteum was decided upon. A provocative Wassermann was recommended and was done. The provocative Wassermann and Kahn reactions were negative. The Frei test for lymphogranuloma inguinale was negative. A high caloric diet was prescribed. She was seen again in the Gynecological Department, and a diagnosis of periostitis was decided upon. The orthopedic surgeon could find no evidence of pathologic processes in the bone. *X*-ray therapy was

* From the Department of Surgery, Northwestern University.

considered on August 3, 1934, but was discouraged by the Roentgenological Department. The possibility of hysteria was considered, and the patient referred to the Department of Neurology and Psychiatry. They found the central nervous system normal. They believed that there was some anxiety or fear neurosis and advised reassurance and phenobarbital. On August 23, after several psychiatric treatments, no improvement was seen, and they did not believe that they could be of help.

On December 7, the patient was re-examined in the Department of Surgery, and a biopsy advised. The patient was admitted to the St. Joseph Hospital on January 3, 1935. Operation was postponed until onset of the menses. At this time a neoplasm, about 2 or 3 cm. in diameter, was palpable in the end of the canal of Nuck just above the labium majus. It was exquisitely tender to palpation.

The blood count was essentially normal with the exception of a mild secondary anemia, and with a slight leucocytosis (12,000), with 65 per cent polymorphonuclear cells. The urinalysis was negative. No family history could be obtained of any similar lesions. The patient was operated upon under general anesthesia. An incision was made in the upper inguinal area, and the canal of Nuck laid bare. A bluish neoplasm came into view surrounded by dense fibrous adhesions, some of them 3 or 4 mm. in diameter. By careful dissection the neoplasm was freed. It was found connected to the round ligament by a firm fibrous adhesion. With difficulty the entire neoplasm could be luxated out, and then completely excised. The canal of Nuck was examined through its entire course and the round ligament followed. No hernial sac was disclosed at any point. The wound was closed and healed by primary union. Convalescence was uneventful. The patient has been observed through five menstrual periods without any further symptoms.

The pathological report was made by Dr. L. E. Hines of the St. Joseph Hospital. It read as follows: The specimen consists of a tumor mass measuring about 1.5 × 2 × 4 cm. It is somewhat nodular and thick fibrous bands extend over the surface. The cut surface is reddish-brown in color and has the gross appearance of fibrous and muscle tissue. The bulk of the tumor is composed of lymphoid tissue containing no lymphoid follicles. Adjacent to the lymphoid tissue is muscle tissue containing islands of modified connective tissue which resembles interglandular stroma of endometrium. In some of these islands are glands lined with low columnar epithelium. They resemble endometrial glands. Diagnosis: prepubic endometrioma.

This case illustrates the importance of a complete differential diagnosis. On physical examination there was little to be found. Neither an inguinal nor a femoral hernia was evident. A very small mass was palpable in the intermenstrual period, but this was difficult to outline. Had this patient presented herself for the first time during a menstrual period, an exquisitely tender mass would have been palpated and might easily been considered an incarcerated omental hernia. (In point of fact in many of the reported cases of endometriosis of the canal of Nuck the patients were operated on with this diagnosis.) The skiagram was of no help. The mottling and roughening of the pubis might, conceivably, have been considered indicative of an inflammatory lesion in the pubis. The bimanual examination of the pelvis was not significant.

Other neoplasms of the round ligament demanded consideration. Gross[5] reported 4 cases of fibromyomata of the round ligament, a lesion which Roustan[6] had reported as early as 1884. Coulson[6a] in 1859 reported a cyst of the round ligament as did Aschenborn[7] in 1880. Leopold[8] has described a cystic myoma of the round ligament. Zweifel[9] has rather exhaustively described the rare round ligament sarcomata. Chronic lymphadenitis must also be ruled out.

The anamnesis, however, defines endometriosis much more clearly than the clinical findings. The endometriomata have the particular quality of swelling and becoming tender during the menstrual period. Bungart's[10] case is the only one we have been able to find in which a gestation occurred. In this case the pain and tenderness were constant, but disappeared when a miscarriage terminated the pregnancy. Endometriomata have been found only during the childbearing period. No record exists of endometriomata having appeared after

the menopause. It may be, however, that, as the pain is present only during the catamenia, they remain without producing

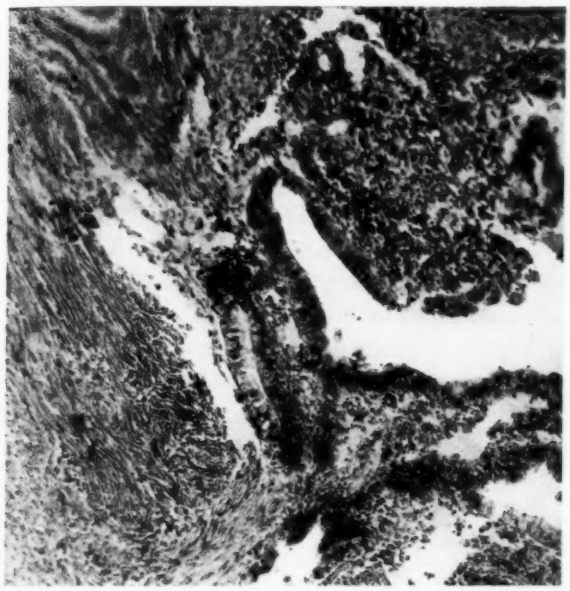

Fig. 1. Endometrial gland and surrounding lymphoid and connective tissue stroma.

symptoms after the climacterium.

Only one condition might be confused after the history has been accurately obtained. It is the herniation of the ovary into the canal of Nuck, first recognized by Soranus of Ephesus in 97 A.D. Watson[11] has collected 175 cases of prolapse of the ovary alone. Wakely[12] has reported 25 personal cases. These cases can probably be explained on a developmental basis. Harbeson[13] states that the ovarian gubernaculum, which is the anlage of the ovarian and round ligaments, becomes attached to the cornu of the uterus. This normally prevents the descent of the ovary into the inguinal canal, even though the gubernaculum is attached to the labium majus. It is conceivable that in some cases the gubernacular fibers do not attach to the uterus so the ovary, simulating the descent of the testis, may descend into the canal of Nuck and even to the labium majus. This condition is, usually, recognized during childhood. Yet cases similar to the author's from the standpoint of the history have been reported in adults. Physical examination may be identical with that of endometriosis, but an inguinal hernia may usually be discerned.

Gynecologists the world over have, in recent years, been on the alert for cases of

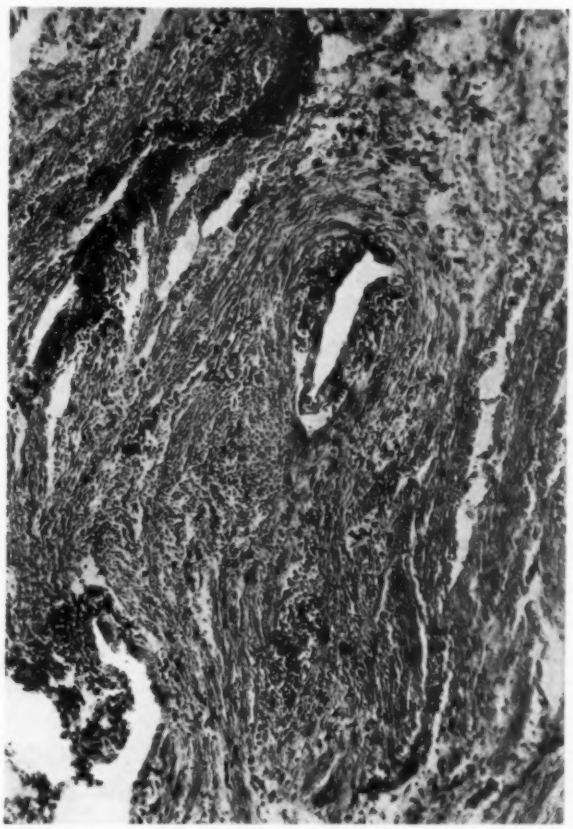

Fig. 2. Group of endometrial glands in lymphoid and connective tissue stroma; smooth muscle tissue abundant in this field.

endometriosis, and have waged a most interesting and illuminating scientific discussion to determine the etiology. The gynecologic pathologists have not yet solved this important problem, but most of them conclude that one single process cannot be held accountable. Several theories have been advanced and each claims its champions. The oldest of these is one advanced by von Recklinghausen:[14] the congenital theory. This presupposes the growth of misplaced rests of the Muellerian or Wolffian ducts. The Wolffian duct lies in close contact with the round ligament before its descent into the inguinal region. Also some authors believe that the histologic appearance of the endometriomata bears some resemblance to that of the Wolffian duct. Cullen[15] believes that the Muellerian duct is more significantly con-

nected, as the endometriomata bear close resemblance to the uterine mucosa. The clinical findings of increase in size and hemorrhage during the menstrual period also bear out such a contention.

The serosal theory was advanced by Iwanoff and Meyer.[16] It suggests that a metaplasia of the peritoneal mesothelium or the vascular endothelium occurs. The metaplastic tissue then invades the surrounding tissues, and this, combined with the reaction of the neighboring tissue, composes the endometrioma.

Sampson[17] has perhaps done more scientific work on this subject than any one other author, and has advanced a theory which, if it has not generally been accorded complete recognition, at least has aroused a great deal of discussion. His "implantation theory" supposes that the epithelial lesions of true peritoneal endometriosis are implantations of fragments of endometrial tissue which have escaped into the peritoneal cavity. Three possible sources are given for the endometrial tissue. (1) From fluids derived from the uterine and tubal mucosa, and escaping through the lumen and fimbria of the tube; (2) from the perforation of an endometrial hematoma of the ovary; (3) from ovulation permitting the fluid contents and perhaps some of the cells of the Graafian follicle to escape into the free peritoneal cavity. Of the three, he believes that the backflow of menstrual blood is the most important if not the only factor. This according to Sampson is shown by the similarity of the lesions; the fact that they occur only in women during their menstrual life; that blood is occasionally seen leaking from the tubes of patients operated upon during the menstrual period, and that this blood may show epithelial cells and bits of endometrial tissue; that often there are several lesions at different stages of development showing that there must be repeated implantations; that the tubes are usually patent and should they be closed, implantation may have taken place before the occlusion had occurred; that the lesions are usually multiple and scattered, showing that the irritation of menstrual blood alone could not have been held accountable; that lesions have been observed in scars of cesarian sections, etc.; that Jacobson[18] has reproduced similar lesions by implantation of uterine mucosa in the peritoneum of rabbits.

Halban[19] has proposed the metastatic theory, which is supported by Sampson, to explain extraperitoneal endometrial implantation. It supposes the metastasis of bits of uterine mucosa through the lymph vessels and veins of the uterine wall.

It seems to us that there is a very close relation between the theory of von Recklinghausen and that propounded by Iwanoff and Meyer. Novak[20] quotes Fischel[21] and other embryologists in saying:

> Each one of the embryonic layers possesses developmental potentialities, which, for various organs, are limited as a result of certain physical or chemical factors, either local or general. Thus it is evident that if the potency of the cells is not used up, so that, if in later life, the same conditions arise which are responsible for the original development of the cells in question, they may be activated into new growth. Thus a germinal epithelial cell retains a considerable degree of unused developmental potency, and with the proper activation, can develop further into a tubal or endometrial epithelial cell.

He believes that the activating substance is undoubtedly of endocrine nature. Novak further states that the celomic epithelium forms the various epithelia of the genital gland, the germinal epithelium, and indirectly the granulosa and lutein cells. The celomic epithelium invaginates to form the lining of the Muellerian ducts. As a result of hormonal influence it assumes a different form in different parts of the genital tract.

In our opinion, if such incompletely differentiated cells, or as Novak calls them, cells retaining developmental potency, remain in tissues other than the uterus, and respond to the hormonal influence that develops a characteristic stroma in the uterus after puberty sufficiently to develop a similar stroma, they must be considered as Muellerian rests. On the other hand, if

the cells are still further undifferentiated and appear as peritoneal mesothelium, and have a similar reaction to the hormonal influence, this might be considered a true metaplasia. Thus we contend that the theories of von Recklinghausen and of Iwanow and Meyer are identical.

Several questions might be asked of this concept so actively championed by such authorities as Novak,[22] Lauche[23] and Robinson.[24] It is conceivable that, as the round ligament is derived from the gubernaculum of the ovary, undifferentiated cells of celomic epithelium may be carried into the canal of Nuck, later, under endocrine influence, to develop into endometrium-like tissue. Yet in our case, the endometrioma, though lying adjacent to this structure, was connected with it only by bands of adhesions. The canal of Nuck, a peritoneal fold which is usually obliterated in the eighth fetal month, may, of course, leave some cells in the inguinal area which may under the same influence change into endometriomata. But it is difficult to conceive how these cells reach the umbilicus. And why, if they are seen at the umbilicus, is the paraumbilical tissue immune?

The points which Sampson brings out to support his implantation theory have already been enumerated. The fact that endometriomata appear only in the female is not, in our opinion, a valid argument, for we do not know what effect the female hormonal influence would have upon cells in the male. That these lesions occur only during the menstrual life of the patient is difficult to prove. That they only produce symptoms during the menstrual life would be a more correct assumption. The potential cells which form the endometrioma may be present before puberty and undergo changes similar to those seen in the uterus at the onset of the catamenia. Novak, Gross, and others have attacked the contention that the blood seen leaking from the tube is an argument for the implantation theory. They contend that this cannot be carrying viable endometrial tissue, and, if it were, the fimbriated orifice would certainly soon be closed by the dense adhesions which surround endometriomata. The multiplicity and scattering of the lesions is not necessarily a sign of implantation, as Novak and Goodall[22] have shown, in ovarian sections, endometrial tissues which in their deeper parts were immature and on the surface definitely mature, thus contradicting Sampson's contention of repeated implantation. That the lesions in the scars of laparotomies are of implantation origin may be countered by the fact that similar implantations of germinal epithelium, or non-differentiated epithelium may have been transplanted at the same time. Novak counters the experiments of Jacobson with the argument that Jacobson transplanted viable and not menstrual endometrium, in animals which do not have similar menstrual reactions to the human.

We agree with Gross in his difference with the metastatic theory advanced by Halban. That metastasis should be into the canal of Nuck which is poor in lymphoid tissues and glands in contrast to the other inguinal glands seems definitely an anatomic anomaly. Sampson has examined the pelvic lymphatics which one would expect to be infiltrated, in the event of a true lymphatic metastasis, and has never found any such evidence, although he did, in one case, find endometrial tissue in a lymph-gland capsule, which it will be remembered is derived from the celomic epithelium. And, were metastases to take place through the uterine veins, we should certainly find endometriomata in far different places than they have yet been described, as in the lungs, etc.

No theory yet advanced seems to account for all of the cases of endometrioma. Yet we cannot conceive of any condition, so identical clinically and pathologically in almost all of the cases, as having several modes of pathogenesis. It seems to us that the endocrine influence, which plays such an important rôle in the symptomatology, must be intimately related to the pathogenesis, as has been intimated by Novak. It would appear extremely valuable to study the changes which a menopause, natural, surgical or radiological, would

have on the clinical and histologic picture of the endometrioma. The occurrence of pregnancy and the clinical changes attendant thereto have been described by Bungart,[10] but unfortunately he did not demonstrate the histolic picture at that time. The effect of other endocrine changes would undoubtedly be of scientific value. Our patient was deliberately operated upon during the period of the mensis, but we were not rewarded with any significant findings. Hemorrhage was present, but not to any marked degree, in comparison to the other reported cases. It also appears significant that in none of the cases did the symptoms arise at the time of the onset of the menses, but rather after varying periods of time following puberty.

The problems of endometriosis are without doubt of great significance, and will bear much more detailed and careful observation before the picture of the pathogenesis is clarified. The tremendous importance of a factual concept of the pathogenesis may be illustrated in that, if Sampson's implantation theory is accepted, extreme care and caution must be used before setting the indication for a uterine curettement. May it here be suggested that it seems odd, if Sampson be correct, that as many curettements are performed for incomplete abortion, with the liberation of truly viable cell and cells of high potential development, these are not more commonly the source of endometrioma?

SUMMARY AND CONCLUSIONS

1. A case of inguinal endometriosis has been described. This case was an excellent example of the difficulties which present themselves to the surgeon in the differential diagnosis. Operation was performed during the mensis and the histologic picture is described.

2. The four most important theories for the pathogenesis of endometriosis have been described. The similarity between the misplaced Muellerian rest theory, and the mesothelial metaplasia theory has been pointed out. The supporting contentions to these theories have been discussed.

3. The importance of observing the effect of endocrine changes upon the endometrioma has been suggested.

REFERENCES

1. ALBRECHT, H. Radical operation or irradiation in rectal endometriosis. *Arch. f. Gynäk.*, 155:74, 1933.
2. PERLMANN, S. Endometriosis of the bladder. *Urol. & Cut. Rev.*, 38: 700, 1934.
3. TEMPLETON, W. K. Umbilical endometrioma. *Calif. & West. Med.*, 41: 330, 1934.
4. LEMON, W. S. and MAHLE, A. E. Postoperative invasion of the abdominal wall by ectopic adenomyoma. *Arch. Surg.*, 10: 150, 1925.
5. GROSS, F. Significance of heterotropic endometrium in surgery. *Deutsche. Ztschr. f. Chir.*, 213: 13, 1929.
6. ROUSTAN. Tumors of the round ligament. *Montpel. méd.*, 2: 101, 1884.

6a. COULSON. A cystic tumor of the round ligament in a woman. *Lancet*, 2: 113, 1859.

7. ASCHENBORN. Cysts of the round ligament in the inguinal canal. *Arch. f. klin. Chir.*, 25: 178, 1880.
8. LEOPOLD. Contribution to the dyskinetic tumors of the pelvis. *Arch. f. Gynäk.*, 16: 402, 1880.
9. ZWEIFEL, E. Clinic of the malignant tumors. Zweifel-Payr, 3: 183.
10. BUNGART. Inguinal endometriosis. *Arch. f. klin. Chir.*, 137: 719, 1925.
11. WATSON. Hernia. St. Louis, Mosby, 1934, pp. 9; 588.
12. WAKELY, C. P. Hernia of the ovary and fallopian tube. *Surg. Gynec. Obst.*, 51: 256, 1930.
13. HARBESON, A. Congenital hernia of the ovary and tube into the canal of Nuck. *Canad. M. A. J.*, 29: 295, 1933.
14. VON RECKLINGHAUSEN. Adenomyomas and Cystadenomas of the Uterine and Tubal Walls. Berlin, 1896.
15. CULLEN. Adenomyoma of the Uterus. Phila., Saunders, 1908, p. 250.
16. MEYER, R. Endometriosis. *Virchows Arch. f. path. Anat.*, 155: 487, 1909.
17. SAMPSON, J. G. *Arch. Surg.*, 3: 245, 1921; 5: 217, 1922; 10: 1, 1925. *Surg. Gynec. Obst.*, 38: 287, 1924. *Boston M. & S. J.*, 186: 445, 1922. *Am. J. Obst. & Gynec.*, 4: 451, 1922; 10: 462; 648; 1925; 12: 459, 1926.
18. JACOBSON, V. Intraperitoneal transplantation of endometrial tissue. *Arch. Path. & Lab. Med.*, 1: 169, 1926.
19. HALBAN, J. Hysteroadenosis metastatica. *Wiener klin. Wchnschr.*, 37: 1205, 1924.
20. NOVAK, E. Misplaced endometrial tissue. *Am. J. Obst. & Gynec.*, 10: 485, 1925.
21. FISCHEL. Quoted by Novak.[20]
22. NOVAK, E. *Bull. Johns Hopkins Hosp.*, 28: 349, 1917.
23. LAUSCHE. *Arch. f. path. Anat.*, 243: 298, 1923.
24. ROBINSON. *Surg. Gynec. Obst.*, 41: 36, 1925.
25. CHRISTOPHER, F. Inguinal endometriosis. *Ann. Surg.*, 86: 918, 1927.
26. SAMPSON, J. G. Pelvis endometriosis and the tubal fimbria. *Am. J. Obst. & Gynec.*, 24: 497, 1932.
27. JACOBSON, V. C. Fate of endometrial emboli. *Arch. Path.*, 15: 1, 1933.
28. SHIRER, J. W. Endometriosis. A pathological study. *Canad. M. A. J.*, 18: 151, 1928.

RECTAL STRICTURE

A CLINICAL ANALYSIS OF 58 CASES, WITH OBSERVATIONS ON 154 FREI-POSITIVE CASES OF LYMPHOGRANULOMA INGUINALE*

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THE Frei test, which was introduced in 1925 as a specific diagnostic test for lymphogranuloma inguinale, has been used routinely since July, 1934, in the New Orleans Charity Hospital on all patients who came under our observation suffering with inguinal buboes, chronic ulcerative and hypertrophic lesions of the vulva, and inflammatory strictures of the rectum, these being the most frequent pathologic forms under which the disease manifests itself. As a result of this routine we were able to identify in the four-months period from July through October, 1934, 154 cases with Frei-positive reactions, the data of which we are herewith reporting. We have observed an even larger number of cases in the four-months period which has elapsed since the first period of observation terminated. Lymphogranuloma inguinale is notoriously frequent in negroes, in whom the physicians of the South have unusual opportunities to observe all varieties of pathologic conditions, and we anticipated a high incidence of the disease because of the large negro population of the hospital. The number of cases, however, has exceeded our most sanguine expectations and has amply verified the prediction of Cole[1] in 1933 that, contrary to the general belief, it is not an uncommon condition but is actually very frequent in large hospitals. Since New Orleans appears to be a veritable hotbed of it, we have been able to study this comparatively new venereal disease in all its varied manifestations, and we have been particularly fortunate in being able to observe 4 cases at autopsy.*

Of the 154 patients upon whom this study is based, 70 were males with inguinal buboes (the characteristic lesion of the disease in that sex); another male exhibited a rectal stricture. Sixty were colored and 11 were white. The 83 female patients, all but 3 of whom were negroes, exhibited inguinal buboes in 8 cases, esthiomène or chronic elephantiasis of the vulva in 12 cases, and inflammatory stricture of the rectum in 57 cases. Also included in the female group were 2 patients with anal granuloma not associated with rectal stricture, 2 with severe granulomatous proctitis without rectal stricture, and 2 with granulomatous lesions of the cervix uteri. All the patients studied proved, on questioning, to be lifelong residents of Louisiana or of adjoining Southern states.

It is my purpose in this communication to report the data only in the group of 58 patients with inflammatory rectal stricture, leaving the remaining cases for a later report. Before leaving the general subject, however, it might be well to say that we seem justified in assuming, on the basis of our experience to date, that the number of patients with lymphogranuloma inguinale who apply to Charity Hospital for treatment in the course of a year probably exceeds 400. If one com-

* As this paper was being typed in its final form a fifth case came to necropsy, the details of which are appended in the section containing the post-mortem findings.

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pares this number with the number of cases of typhoid fever, let us say, which approximate 200 yearly, the economic and social, as well as the medical importance of lymphogranuloma inguinale immediately becomes apparent. Certainly from the point of view of incidence it deserves to be called the fourth venereal disease and to merit the attention which has been focused upon it throughout the world since 1925.

ETIOLOGY

In 1875 Fournier[2] described a syndrome consisting of rectal infiltration and stricture with multiple fistulae, which he considered due to syphilis and which became known as the "anorectal syphiloma of Fournier." The description was sound but the use of the term was peculiarly unfortunate, for it persisted in the literature and was distinctly prejudicial in that it gave rise to the prevailing view, categorical statements of which still appear in all textbooks, that the etiology of this lesion is luetic and that syphilis is responsible for most rectal strictures. Since the Frei test was first used for the diagnosis of the condition, however, which was done by Frei and Koppel[3] in 1928, considerable evidence has been adduced to show that lymphogranuloma rather than syphilis is responsible for the overwhelming majority of rectal strictures, and that point of view is now rather generally accepted. This evidence, developed along clinical, experimental and pathological lines, may be briefly summarized as follows:

1. At least 90 per cent of all patients with inflammatory rectal strictures give positive Frei reactions. Our personal experience, 55 out of 58 cases, is essentially in accord with the experience of other observers. In 1928 Frei and Koppel put the first 5 cases on record, and numerous other reports have appeared since then. To mention only a few, Bensaude and Lambling[4] found 24 Frei-positive reactions in 27 cases of rectal stricture studied in the Proctological Clinic of the Hôpital St. Antoine in Paris. De Gregorio and Murúa,[5] working in Spain, obtained positive reactions in all the 19 cases they studied. Jersild[6] obtained 10 positive reactions in 11 cases, some of which were associated with pudendal lesions. In this country the earliest observations were those of De Wolf and Van Cleve,[7] who in 58 cases of lymphogranuloma inguinale found 3 cases of rectal stricture, all with Frei-positive reactions. Cole[1] later reported 10 positive reactions in 10 cases, Bloom[8] 7 in 7 cases, and Lee and Staley[9] 14 in 16 cases. Stannus,[10] to whom we are indebted for a complete and valuable compilation of the world literature on lymphogranuloma inguinale, is of the opinion, in view of the unquestioned specificity of the Frei reaction, that the cumulative evidence proves quite conclusively that the majority of patients with rectal stricture are infected with the virus of lymphogranuloma inguinale. It is assumed, of course, that the precautions pointed out by Frei himself are taken in the preparation of the antigen with which the test is made.*

2. Pus from fistulae-in-ano occurring in patients with rectal stricture has given positive intradermal tests in patients suffering from lymphogranuloma inguinale, as noted by Nicholas, Lebeuf and Charpy.[14] We ourselves have been able to confirm this observation and we have also obtained positive intracutaneous reactions in patients with buboes by the use of the purulent discharge from the rectum itself. This type of evidence naturally must be interpreted with caution, since B.coli filtrates in themselves may give positive intracutaneous reactions in some patients,

* In order to eliminate completely the possibility of an occasional false positive reaction with the use of human material for antigen, we[11] have produced experimental lymphogranuloma inguinale meningo-encephalitis in white mice and monkeys (common marmosets) after the method of Hellerström[12] and of Levaditi[13] and his co-workers. The diluted sterilized brain emulsions (20 per cent) of infected white mice and monkeys give intradermal reactions comparable to those obtained with antigens prepared from acute lymphogranuloma inguinale buboes after the method of Frei.

as noted by Hillsman, Wilshusen and Zimmerman.[15]

3. Pus from the fistulae associated with rectal stricture may produce in experimental animals lesions indistinguishable from those obtained with infected material from the inguinal buboes associated with lymphogranuloma inguinale. Similar lesions have also been reproduced with infected tissue from patients who exhibit the anorectal syndrome. Ravaut, Levaditi, Lambling and Cachera[16] have successfully inoculated guinea pigs with ulcerated tissue from the anus and rectum and have transferred the infection, in turn, from them to monkeys, producing in the latter animals meningo-encephalitis indistinguishable from that obtained with material from buboes.

4. Pathological material obtained at biopsy, surgical resection and necropsy shows no specific inflammation indicative of syphilis but rather a type of chronic inflammation which exhibits certain features of lymphatic involvement apparently common to all lesions of lymphogranuloma inguinale. These manifestations occur in the pudenda as well as in the rectum, and they have been observed in the scrotum and penis in cases of elephantiasis following total excision of infected inguinal glands, as noted by Barthels and Biberstein.[17] This point will be considered at greater length under the heading of Pathology.

ANALYSIS OF 58 CASES OF INFLAMMATORY RECTAL STRICTURE

This group of cases, which is substantially larger than any single group reported in the literature to date, emphasizes (Table 1) the overwhelming predominance of this disease in the colored race and particularly in colored females. In the 58 cases are included 54 negro females, but only one negro male, and only 3 white females. The white race is not immune to the disease, but it exhibits a marked predilection for negroes, the ratio in this material being at least 10 to 1. A heightened race susceptibility, however, seems only part of the explanation. A more likely explanation lies in the sexual promiscuity and the poor hygiene almost universal among Southern negroes. That the virus of lymphogranuloma inguinale is harbored and propagated primarily by negro women, who remain infective for a considerable period of time, is borne out by the fact that a number of the white male patients with inguinal buboes admitted intercourse with black or "high yellow" women. The statement, so often repeated in the literature, that lymphogranuloma inguinale is essentially a disease of prostitutes, cannot be substantiated by our data, though it cannot be denied that the condition is more prevalent among patients of the lower social strata.

Table 1

DATA IN 58 CASES OF INFLAMMATORY RECTAL STRICTURE

Sex. Female 57. Male 1 (negro).
Race. Negro 55. White 3 (all females).
Age. Limits twenty-two to sixty years. Average age thirty-four years.
Under thirty years 21; under forty years 22.
Under fifty years 10; under sixty years 5.
Wassermann Reaction Positive 10. Negative 37 (7 after treatment). Undetermined 11.
Frei Reaction. Positive 55. Negative 1. Equivocal 2.

The age limits (Table 1) were twenty-two to sixty years, with a mean age incidence of thirty-four years, and it is interesting to compare this figure with the mean age incidence for other groups of lesions observed in all the cases of lymphogranuloma inguinale for which this information was available (Table 11). It was practically the same, thirty-two years, for the 11 patients with esthiomène or chronic elephantiasis of the vulva without rectal stricture, but it was considerably less in the patients who presented buboes (the initial infection), being twenty-three years for the female group and twenty-six years for the male group. The difference of nearly a decade would seem to indicate that infection with the lymphogranuloma inguinale virus which results in esthiomène and chronic elephantiasis of the vulva or in inflammatory stricture of the rectum runs a chronic, low-grade, protracted and

often latent course extending over many years. The long duration of symptoms, in this group of cases varying from three months to fifteen years, is also in accord with this hypothesis.

TABLE II
AVERAGE AGE INCIDENCE IN 142 CASES OF LYMPHOGRANULOMA INGUINALE

	Cases	*Years*
Buboes: male	70	26
female	8	23
Esthiomène and elephantiasis	11	32
Rectal strictures	53	34

The Wassermann reaction was positive in 10 cases, undetermined in 11, and negative in 37. Seven of the latter group of patients gave a history of having received "shots," and it is quite possible that a number of others had had antiluetic treatment. Even when due allowance is made for the treated cases, it is clear that less than half of the patients in the series presented serologic evidence of lues, in spite of the fact that the study is based upon a group of individuals in whom lues is rampant. There has been an entirely illogical tendency in the past to assume, chiefly on the basis of comparable data, that syphilis was the chief cause of stricture of the rectum, but these figures indicate that the incidence of syphilis in patients with lymphogranuloma inguinale is probably no greater than it would be in a similar group of negro patients under treatment for some other venereal disease such as chancroid or gonorrhea.

The Frei reaction was carried out in every case in the group with 55 positive results, one negative result and 2 equivocal results. The intensity of the reaction to the same antigen varied considerably in different patients, which may be interpreted as indicating that different strains of the virus do not possess the same virulence, or at least that they induce varying degrees of skin allergy. A number of cases gave at first an equivocal or weakly positive Frei reaction but subsequently gave an unmistakably positive one when the test was repeated with a more potent antigen. Such variations in potency of antigen are, of course, inevitable in the absence of a method of biologic assay, and the fact that the tests were repeated in several doubtful cases may explain the unusually high incidence of positive reactions in this special series.

The single negative response was obtained in a negress who was practically *in extremis* when the test was made and who at autopsy several days later showed a chronic granulomatous ulcerative and stenosing proctitis and periproctitis, with multiple fistulae. There is strong evidence, as we shall point out later, that the findings in this and other autopsies represent the terminal stage of inflammation of the rectum by lymphogranuloma inguinale. It is pertinent, in connection with this case, to cite the reminder of Cole, that in certain instances of prolonged illness and lessened general resistance there may be an anergy, and his warning that in such cases the disease should not be ruled out on the basis of a single negative reaction.

One of the equivocal reactions was obtained in a feeble, emaciated negro woman, sixty years old, and the other was obtained in a young white woman, who left the hospital before the test could be repeated. In the latter case a rectal biopsy showed chronic inflammation indistinguishable from that seen in the Frei-positive cases of rectal stricture.

ASSOCIATED LESIONS

Of the various lesions (Table III) associated with inflammatory rectal stricture, anal tags are the most frequent, being observed in 62 per cent of the 58 cases. These fleshy or rubbery perianal tags are frequently called hemorrhoids by the inexperienced observer, but histologic section (Fig. 1) proves them to be fibroepithelial polyps showing chronic inflammation, with keratosis, fibrosis and numerous dilated lymphatics rather than veins. If one may be permitted to coin a term for this type of anal tag, "lymphorrhoids" would seem to be quite appropriate. Occasionally the anal excrescences may

develop as a large, cauliflower-like cluster encircling the anus (Fig. 2) but the histology is essentially the same. This type of anal lesion was observed in 2 cases of rectal stricture, as well as in 3 other cases, all in colored women, with positive Frei reactions but without stricture. We propose keeping the latter group of patients under careful observation, with the idea of observing whether in time they too will develop rectal strictures.

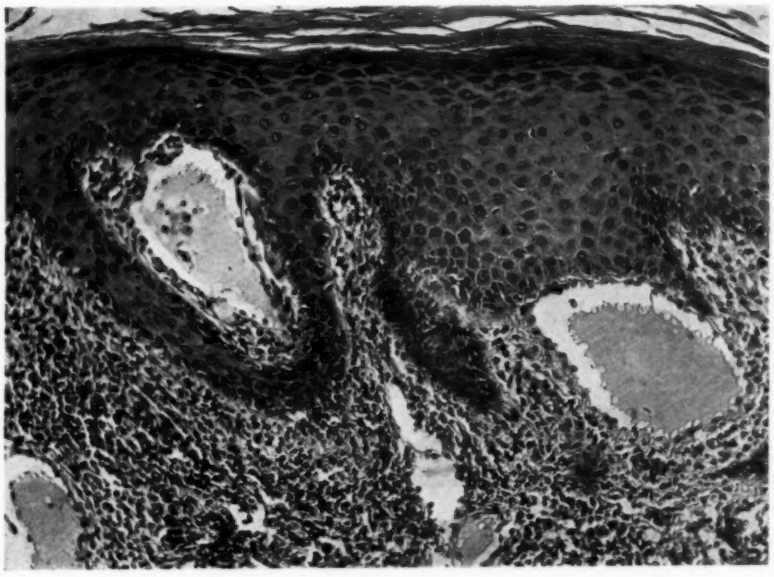

Fig. 1. Anal tag taken from lesion simulating hemorrhoid in case of rectal stricture. Note keratosis, chronic inflammation and numerous dilated lymphatics.

Table III
Incidence of lesions associated with rectal stricture

Type	Number	Per Cent
Anal tags ("hemorrhoids")	35	62
Proctitis	32	57
Induration of rectovaginal septum	25	45
Fistula-in-ano, ischiorectal abscess	18	32
Rectovaginal fistula	8	14
Pellagra	8	14
Esthiomène, elephantiasis of vulva	6	11
Inguinal adenitis (old scar)	2	4

Proctitis, as evidenced by a sanguinopurulent or frankly purulent rectal discharge, was noted in 57 per cent of the cases and is presumably due to secondary infection by the usual colonic bacterial flora. The patients in this group complain of "corruption" coming from the rectum, particularly when they strain at stool, and a more or less copious discharge may be produced by rectal dilatation or even by manual examination.

Fistula-in-ano is a frequent concomitant of inflammatory stricture of the rectum, particularly of those cases with associated proctitis, and was observed in approximately one-third of this series. When the tract is not too tortuous, such fistulae may be traced by probe into the rectum, most often at a point several centimeters

Fig. 2. Cauliflower type of anal lesion in rectal stricture of four years' duration.

above the anal orifice. They are usually multiple (Fig. 3) and the viscid gray or grayish-yellow mucopurulent discharge that oozes from them appears identical with the discharge observed in proctitis. Sometimes, as the result of conservative treatment, they heal spontaneously, but there is usually more or less extensive perianal scarring (Fig. 4). They tend to recur after surgical excision, so that operative procedures directed toward their extirpation are of doubtful value.

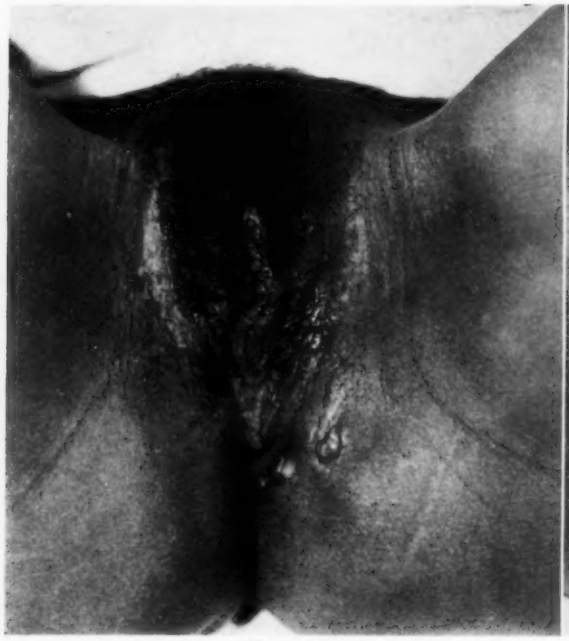

Fig. 3.

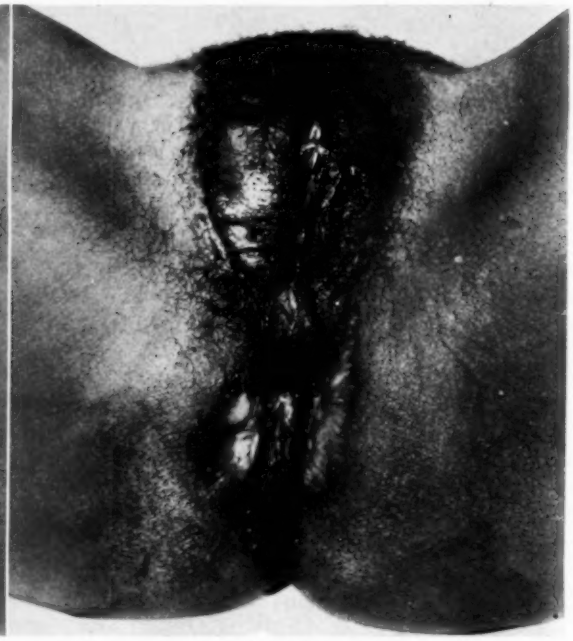

Fig. 4.

Fig. 3. Fistula-in-ano in rectal stricture of two years' duration.
Fig. 4. Rectal stricture of nine months' duration. Note draining fistula-in-ano and perianal scarring, also hypertrophy of right vulva.

Induration of the rectovaginal septum, which was apparent in almost half of this series, is readily explained by the location of the anorectal lymph nodes and lymphatic plexuses in the anterior wall of the rectum. It is to this group of deep pelvic lymph nodes that most primary lesions occurring in women are likely to extend, as has been demonstrated by Jersild, Barthels and Biberstein, and others. As these investigators have emphasized, only a small proportion of the primary lesions in the female, those situated on the external labia or the clitoris, drain to the inguinal group of lymph nodes, in contradistinction to the male group, in which inguinal buboes are the rule. In our opinion the importance of induration of the rectovaginal septum as an aid in differential diagnosis has not been sufficiently stressed.

One of the most distressing complications of inflammatory stricture of the rectum is rectovaginal fistula, which was observed in 14 per cent of this series. The fistulous communication tends to be fairly large and is located just within the vestibule. Occasionally the patient is unaware of her condition until pelvic examination reveals it, but most often she has noted the passage of feces by vagina. One of our patients actually developed such a fistula while she was under our observation. The condition may persist for years. In several of our cases surgical repair had been attempted, but recurrence is the rule because the underlying granulomatous proctitis favors the development of fistulae and does not permit healing.

Chronic ulcerative or hypertrophic lesions of the vulva were noted in association with the rectal stricture in approximately 10 per cent of these patients, as

compared with 12 Frei-positive cases of esthiomène and chronic vulvar elephantiasis, without rectal stricture, observed over the same period. Our material is not sufficiently large to warrant categorical statements, but it would seem that while simultaneous involvement of the rectum and pudenda is not unusual, it is more common for the rectal and vulvar lesions to occur independently.

Some further discussion of this point is necessary. From the histological studies of Barthels and Biberstein[17] we know that with involvement of the group of anorectal lymph nodes of Gerota on the anterior rectal wall by the lymphogranuloma virus, there result lymphatic obstruction and retrograde lymphangitis, with secondary chronic inflammation. If the genitalia are involved, a condition of chronic elephantiasis of the vulva or of ulceration (esthiomène) slowly develops. On the other hand, if the lymphatic drainage of the rectum is affected, an inflammatory stricture of the rectum may eventually develop. If, however, the retrograde lymphangitis and the associated chronic inflammation of the adjacent tissues extend in both directions, the genital and rectal lesions may coexist, as in the complete genito-anorectal syndrome. It might be added that to speak of the anorectal and the genito-anorectal syndrome as separate conditions is unnecessarily confusing. They are both manifestations of a single clinical and pathological entity, with variations occasioned by the direction of spread of the lymphangitis and the consequent inflammation of the connective tissue.

In the male, as Lee and Staley[9] have recently reiterated, rectal strictures develop as the result of primary anal infection through pederasty or occasionally as a result of the passage of the virus along collateral lymphatics from a primary lesion on the glans penis or the prepuce. In this connection, the history of case LI of this group is particularly instructive.

The patient, a negro male, aged twenty-five, was first observed in 1930, at which time a "growth around the rectum" was diagnosed as condyloma and was treated by cauterization. In 1932 he was again treated in the hospital, this time for "anal granuloma." During the succeeding two years he received intensive antiluetic therapy, without any results, and when he was seen in 1934 he exhibited a typical inflammatory rectal stricture with extensive perianal scarring. The Frei reaction was strongly positive. On careful questioning it was possible to elicit from him a story of the practice of pederasty during a jail term in 1929.

While there is convincing evidence that the overwhelming majority of inflammatory rectal strictures are due to infection with the virus of lymphogranuloma inguinale, and while some students of the disease, such as Stannus, would explain all rectal strictures on this etiologic basis, one must not be overzealous in attributing all chronic ulcerative or hypertrophic lesions of the vulva to the same cause. There is reason to believe, from the clinical and pathologic evidence at hand, that vulvar lesions constitute a mixed group, as yet ill-defined, which require further study and which often present a perplexing problem as to diagnosis and the choice of appropriate therapy.

A large proportion of them, however, are undoubtedly due to lymphogranuloma inguinale, and we have personally observed 18 such cases, all with Frei-positive reactions, within a period of five months at Charity Hospital. Biopsy in a case of this type shows a perilymphangitis and thromboendolymphangitis with marked dilatation of the lymphatics, and the paravascular infiltration with small round cells around the lymph channels accompanying the larger blood vessels can be differentiated without difficulty from the perivascular type of infiltration seen in luetic lesions. It is not unlikely, it might be added, that lymphogranuloma inguinale was responsible for many of the 26 cases of vulvar elephantiasis reported by Witherspoon[18] from the records of Charity Hospital and considered chiefly of syphilitic etiology,

since they were all observed before the introduction of the Frei test in New Orleans.

Within the same five months in which the 18 cases just described were noted, the author has also seen apparently similar lesions of the vulva of many months' duration in patients with positive Wassermann but negative Frei reactions, and such cases have cleared up under antiluetic therapy. We have also observed Frei-negative tests in cases apparently due to granuloma venereum, all of which improved with the intravenous administration of tartar emetic. Such facts make it clear that the Frei reaction has been of great value in differentiating the cases of esthiomène and elephantiasis of the vulva due to lymphogranuloma inguinale from those caused by syphilis and granuloma venereum.

Adrexal disease was very common among these patients, as was endocervicitis, manifested by leucorrhea. Before attaching undue significance to this particular association, however, it would be well to remember that pelvic inflammatory disease has an enormously high incidence among colored women in general, representing over a ten-year period as much as 35 to 40 per cent of the negro gynecological admissions to Charity Hospital. It is not warranted, therefore, to assume, as some recent writers (Ravaut, Seneque and Cachera[19]) have done, that these pelvic lesions are caused by lymphogranuloma inguinale. Indeed, in the absence of such definite evidence as would be furnished by surgical resection, biopsy and necropsy, that hypothesis seems entirely unwarranted.

In only 2 instances could there be elicited a history of previous inguinal adenitis, confirmed by the finding of an old scar. It would seem that as a rule the women in whom the primary lesion extends to the groin are spared the consequences of pudendal or rectal involvement. It is not inconceivable that multiple primary lesions may account for the occasional simultaneous lymphadenitis of the inguinal and deep pelvic lymph nodes. The finding of an old inguinal scar in a patient with proctitis or esthiomène should make one suspect lymphogranuloma inguinale, but its absence does not in any way militate against the diagnosis.

An unusual and significant coincidence is the association of pellagra with the rectal stricture in 8 patients in this series, some of whom exhibited sore tongue and gastro-intestinal symptoms in addition to the characteristic dermatitis. Clearly an incidence of one in every 7 cases is too great to be fortuitous and indicates, rather, a positive association between the two conditions. In most instances it could be established from the history that the symptoms of stricture antedated the onset of the dermatitis, and it cannot be reasonably maintained, therefore, in the face of this chronology, that the pellagra is in any way responsible for the stricture. The converse appears to be true. These patients, all of them of the colored race, were drawn from a poverty-stricken social stratum, subsisting on a restricted, low-vitamin diet, and it seems logical to infer that the additional dietary restriction which patients with stricture voluntarily impose upon themselves as a result of their chronic low-grade intestinal obstruction suffices to throw some of them, at least, into a state of vitamin B2 insufficiency. In all cases the pellagra improved following symptomatic treatment of the rectal stricture and the usual dietary regime, but a tendency to recurrence was noted.

PATHOLOGY

From the foregoing discussion it is quite clear that it is now possible to separate from the group of conditions roughly classified as chronic granulomata of the intestine another clinical and pathological entity, chronic ulcerative stenosing proctitis and periproctitis, the etiologic factor of which is not syphilis, as has hitherto been assumed, but lymphogranuloma inguinale. It cannot be denied categorically that an occasional case of rectal stricture

may be luetic in origin, but the diffuse rectal infiltration associated with stenosis, which was formerly considered syphilitic, in the light of recent investigations appears to be a typical manifestation of lymphogranuloma inguinale in the female, and to represent the advanced or terminal stage of the pathologic process. All such cases, therefore, should be investigated from the standpoint of lymphogranuloma inguinale and with the Frei test, and the diagnosis of luetic stricture should be reserved for those rare cases in which an actual gumma is demonstrated in the mucosa or the submucosa of the rectum.

As early as 1897 Kaufmann[20] described this entity in the form of a case report, and he describes it again, in greater detail, in the last (1929) edition of his textbook, still with uncertainty as to the etiology, it is true, but otherwise in terms that might well be applied to the type of rectal stricture with which this paper is concerned:

> Chronic ulcerative stenosing proctitis and periproctitis as a disease is not uniform in etiology but probably is due in most cases either to syphilis or gonorrhea of the rectum; it occurs almost exclusively in females. . . . The ulcerated portion of the rectum is usually considerably stenosed, sometimes extraordinarily shortened and dilated above. The muscularis and also the periproctal tissue are often considerably thickened. The rectum, with rare exceptions, is firmly adherent to its vicinity. . . . Fistulae lead from the periproctitic tissues to the perineum, vagina and vulva, rarely to the bladder, and still more rarely to the abdominal cavity. In most instances elephantiasis-like proliferation occurs. The labia majora are thickened to firm rolls, and around the anus are condyloma-like pedunculated excrescences which block the anal opening.

A careful perusal of Kaufmann's full description leaves little doubt, as we have intimated, that the lesion he is describing is identical with inflammatory rectal stricture as seen in lymphogranuloma inguinale.

The able pathological researches of Barthels and Biberstein[17] have clarified the histologic features of the lesion, which may be briefly summarized as follows: destruction and ulceration of the mucosa;

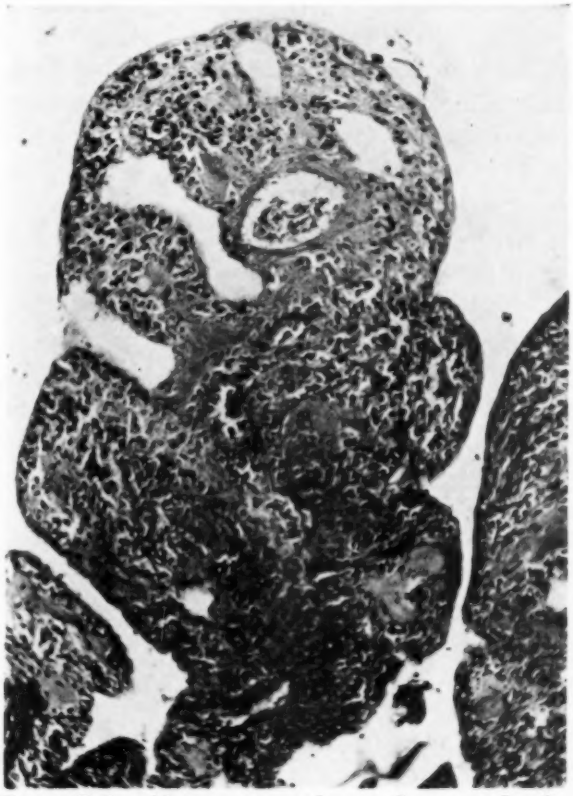

Fig. 5. Polypoid mucous membrane of rectum showing chronic inflammation and numerous dilated lymphatics with perilymphangitis.

infiltration of the muscularis by focal miliary accumulations of lymphocytes and plasma cells; dilatation of the lymphatics, with perilymphangitis (paravascular) and endolymphangitis. The blood vessels, as in any chronic lesion, show endarteritis, with marked narrowing. The indurated periproctitic fat and connective tissue likewise show paravascular and perivascular infiltration. The features enumerated seem to be constant in all reported cases, and we ourselves have repeatedly observed them in our biopsy and necropsy material. (Fig. 5.) Biopsy, it should be emphasized, should always be supplemented by the Frei test, since it scarcely enables one to make a diagnosis more definite than chronic inflammation, even when it causes one to suspect lymphogranuloma inguinale.

SYMPTOMS

The symptoms of inflammatory rectal stricture may be clarified by considering them in five large groups (Table IV), namely, low-grade obstruction, infection, associated lesions, malnutrition, and constitutional symptoms.

TABLE IV
SYMPTOMS OF INFLAMMATORY RECTAL STRICTURE

Low grade obstruction	chronic constipation painful straining at stool thin, ribbonlike stools
Infection	blood and "corruption" diarrhea tenesmus
Associated lesions	"hemorrhoids" (anal tags) fistula-in-ano ischiorectal abscess rectovaginal fistulae
Malnutrition	loss of weight anemia pellagra
Constitutional (especially with proctitis)	headache backache weakness fever

All of these patients gave a history of chronic constipation, often extending over a period of many years, and also of painful straining, with the production of thin, ribbon-like stools. Proctitis, as evidenced by a sanguino-purulent or frankly purulent discharge, was found, as we have pointed out, in more than 50 per cent of the patients, but to elicit the information careful questioning is always necessary. One must ask the patient specifically whether she passes any blood or "corruption" in the stool, especially when she is straining. The rectal discharge is viscid, mucopurulent in character, with a variable admixture of blood, and is grayish-red or grayish-yellow in color. The same type of discharge may be produced upon the withdrawal of the rubber bougie following rectal dilatation, or upon slight pressure in the area of fistula-in-ano. With the onset of an acute proctitis the symptoms may change from those of obstipation to diarrhea and tenesmus.

A considerable number of these patients come to the clinic or seek hospitalization for the relief of "hemorrhoids" (anal tags), in ignorance of the existing stricture. Still others complain chiefly of fistulae-in-ano or of rectovaginal fistula. The importance of routine rectal examination cannot be overemphasized in distinguishing inflammatory rectal strictures due to lymphogranuloma inguinale from these other rectal conditions, but it is easy to comprehend how in the busy admitting room of a large general hospital such examinations may be omitted, which explains why an appreciable number of such cases are admitted masquerading under the diagnosis of hemorrhoids, fistulae-in-ano or perirectal abscess.

The manifestations of malnutrition among most of these patients were quite evident. The majority showed a visible loss of weight and many showed conspicuous wasting. The strikingly high incidence of associated pellagra has already been emphasized. Among the constitutional symptoms noted, backache, fever, headache and weakness were the most frequent and were particularly distressing in severe cases of secondary proctitis. Patients with proctitis all have some degree of fever, the temperature usually ranging from 100° to 103°F. Following rectal dilatation, a febrile reaction with chilly sensations, lasting one or two days, is a common occurrence.

DIAGNOSIS

Given a patient with a rectal stricture that is not postoperative or neoplastic in nature, the probability of lymphogranuloma inguinale must always be kept in mind. If the patient is a negress the probability is still further enhanced, though it must not be forgotten that the disease can also occur in males and in the white race. The long duration of symptoms, usually several years, militates against the diagnosis of carcinoma, although biopsy should be done in every suspicious case. It is not usually very helpful, as we have pointed out, in making the diagnosis of lymphogranuloma inguinale, but

it is essential to eliminate the possibility of malignancy, especially when the stricture is too high in the rectum to permit satisfactory manual palpation. It should also always be done whenever the Frei reaction is equivocal or negative. The presence of an associated proctitis, as evidenced by a viscid purulent or sanguinopurulent discharge, and the presence of fleshy anal tags, fistulae-in-ano, perianal scarring and rectovaginal fistula, should also make one suspect the condition. The association of rectal stricture with chronic ulcerative or hypertrophic lesions of the pudenda not obviously due to syphilis or granuloma venereum constitutes presumptive evidence of the diagnosis of lymphogranuloma inguinale, although the absence of the associated lesions cannot fairly be regarded as significant. The same holds true of inguinal scars resulting from old buboes: their presence is significant but their absence means nothing.

On rectal examination there is noted, usually within a few centimeters of the anus, an indurated, rather tight stricture, which nine times out of ten is annular in type. In the remaining 10 per cent of cases it is tubular and more diffuse. At least 80 per cent of the strictures (Table v) occur within 6 cm. of the anal orifice and practically all of them are situated within reach of the examining finger. *X*-ray examination with barium enema is scarcely necessary, therefore, except in the occasional case in which the stricture is too high to permit digital examination.

Table v

Location of Rectal Strictures

Just within anal sphincter	2
Less than 4 cm. from sphincter	24
4 to 6 cm. from sphincter	16
6 to 10 cm. from sphincter	4
High, at tip of examining finger	3
Type. Annular	49
Diffuse, tubular	5

Thickening and induration of the rectovaginal septum, which occurs in practically half of all cases, we regard, as we have already pointed out, as a sign of considerable value in differential diagnosis. Occasionally there is found an inflammatory mass of rather large size bulging into the rectum on its anterior aspect. In addition to the stricture there is invariably present some degree of induration of the lowermost rectal segment, and the thick, irregular, band-like or corrugated feel of the lumen below the stricture one learns by experience to regard as very characteristic. The granulomatous proctitis frequently involves the rectum below the stricture as far down as the anus, but the most distal portion may be spared. Most strictures, when first examined, are exquisitely tender and scarcely admit the index finger, so that palpation of the proximal rectal mucosa is not possible. After relaxation of the stricture following repeated dilatation by manual or other methods, there is usually noted in this area an abrupt transition from the indurated, stenosed, ulcerated, granulomatous portion to the smooth, relatively uninvolved bowel proximal to the stricture.

A positive Wassermann reaction, as has been pointed out, is not necessarily of diagnostic significance, since lymphogranuloma inguinale tends to affect a class of patients in whom there is normally a high incidence of syphilis. The Frei reaction, on the other hand, has come, and rightfully, to be regarded as specific for lymphogranuloma inguinale. Fully 90 per cent of inflammatory strictures of the rectum will give a positive Frei reaction, though a negative reaction, especially in debilitated and cachectic subjects, does not rule out the disease, at least until the test has been repeated with a more potent antigen.

Therapy

There is no evidence that spontaneous healing ever occurs in rectal stricture due to lymphogranuloma inguinale, nor is any specific therapy available at the present time. Rational therapeutic measures, therefore, must be directed toward the alleviation of the symptoms of the disease and the prevention of distressing complications. Constipation may be re-

lieved by the regular, liberal use of some one of the mineral oils. The symptoms of proctitis can frequently be relieved by hot Sitz baths. A high caloric, well-balanced, vitamin-rich diet is indicated to prevent pellagra and loss of weight, and to minimize the constitutional effects of prolonged infection.

Adequate dilatation of the stricture is clearly one of the most important active measures that can be undertaken for the well-being of these patients, but to be effective it must be done at regular intervals. It is our practice at Charity Hospital to request them to present themselves at the out-patient clinic every two weeks for dilatation, which is usually accomplished with rubber bougies. Patients with advanced tight strictures are submitted to dilatation in the hospital, under spinal analgesia. It is often difficult to make patients of the class in which this disease occurs realize the importance of regular treatment, and they are inclined to neglect themselves until they become incapacitated by neglect of their condition or until a severe secondary proctitis forces them into the hospital again.

Surgery is not usually desirable. The excision of fistulous tracts about the rectum is in most cases ill-advised because the underlying granulomatous proctitis prevents prompt healing and favors recurrence. Colostomy is usually an unnecessarily drastic procedure, since equally good results can be accomplished by repeated dilatation, under spinal analgesia if necessary. In long-standing obstruction, however, requiring emergency treatment, temporary colostomy may be indicated. Following adequate dilatation of the stricture, an attempt should be made to close the opening. The chronicity of the disease and the lack of any adequate medical treatment might lead one to consider the advisability of resection of the rectum in certain extreme instances. This procedure, however, would be a formidable one in the negro patients who would need it most, since they seek treatment only late in the disease, when the proctitis is far advanced, and when the more or less extensive periproctitis eventually results in what, for all practical purposes, is a frozen pelvis.

On the basis of favorable reports by this method in the treatment of buboes, tartar emetic by the intravenous route was used in many of these patients. The results to date have not convinced us that the drug is of any value in the treatment of rectal stricture.

No specific therapy, as we have said, is yet available. The results of repeated injection with lymphogranuloma inguinale antigen in an effort to build up the patient's immunity to the virus are still inconclusive, and much more investigation will be required before the value of the treatment can be established. Efforts to develop an attentuated form of lymphogranuloma inguinale virus are now in progress in our laboratory but have not advanced beyond the experimental stage. This new approach clearly offers the most hopeful possibilities yet to be suggested in regard to prophylaxis and even therapy, and warrants a thorough investigation.

CASE REPORTS

Since most communications on rectal stricture have dealt with the subject only in its broad general aspects, with most of the emphasis on etiology and pathogenesis, it seems justified to include in this communication a small number of case abstracts, in order that physicians likely to encounter the disease in their practice may be conversant with the presenting symptoms, the essential physical findings, and the laboratory data. The following unselected and consecutive case abstracts comprise the first 10 of the group of 58 cases herein reported.

Case 1. J. A., a negro female, aged thirty-seven, had received hospital treatment seven years ago for the rectal stricture which she presented on admission. She had cardiac decompensation at this time, and was psychotic and incontinent. Physical examination revealed a rectal stricture which admitted one

finger, a rectovaginal fistula, anal tags, and several fistulae-in-ano. The labia were markedly enlarged. She had draining sinuses in both inguinal regions, and deep infected decubitus ulcers. The Wassermann reaction was positive and the Frei test negative. The patient was *in extremis* when observed and died several days later. Necropsy revealed a chronic ulcerative stenosing proctitis and periproctitis with multiple fistulae, and a similar ulcerative stenosing lesion in the sigmoid, with an ileosigmoidal fistula. Further details of the necropsy findings are reported under that heading.

Case II. D. C., a negro female, aged forty-eight, gave a history of tenesmus and difficult bowel movements for at least eighteen months. Physical examination revealed a rectal stricture which could be dilated to admit two fingers, and a rectovaginal fistula just inside the anal sphincter, for which repair had been previously attempted without success. The Wassermann reaction was negative and the Frei test was +++.* Routine treatment was undertaken.

Case III. S. R., a negro female, aged thirty, had a history of rectal stricture and proctitis of at least two years' duration. For the last eight months she had complained of amenorrhea, a purulent discharge from the rectum, increasingly difficult bowel movements, and pain in both inguinal regions. Physical examination revealed a bulging mass in the anterior rectal wall, with ulceration of the rectal mucosa and draining sinuses around the anus. The Wassermann reaction had been positive a year ago but was now negative after treatment. The Frei test was ++. Routine treatment was undertaken.

Case IV. B. L., a negro female, aged thirty-five, was admitted for the treatment of pellagra, her chief complaints being dermatitis, sore mouth and tongue, diarrhea and increasing weakness for the last five months. Two years before she had had hospital treatment for a rectal stricture associated with proctitis. Physical examination revealed an irregular, annular stricture just within reach of the examining finger, which could be easily dilated up to a No. 8 bougie. There was a profuse sanguinopurulent rectal discharge. The Wassermann reaction was not determined and the Frei test was +. Routine treatment was undertaken.

Case V. B. M., a negro female, aged thirty-one, had had a rectal stricture for about four years. Physical examination revealed numerous firm, polypoid excrescences about the anus, 1 to 2 cm. in diameter, and a rectal stricture which admitted one finger; it was located about 10 cm. above the anus and was associated with induration of the rectal wall. The Wassermann reaction was negative and the Frei test ++. Routine treatment was undertaken.

Case VI. C. S., a negro female, aged twenty-five, was admitted for the treatment of pellagra and rectal stricture. The story of dermatitis, loss of weight and diarrhea covered about a year. The patient was markedly emaciated. Physical examination revealed an annular constriction 4 cm. above the anus, with nodular mucosa just below it. *X*-ray examination following barium enema showed a slight narrowing of the rectum in the midportion. The Wassermann reaction was positive and the Frei test ++. Routine treatment was undertaken for both conditions.

Case VII. K. S., a negro female, aged thirty-six, was admitted for the treatment of pellagra and rectal stricture. She had been previously treated in the hospital for the rectal stricture, and on this admission she complained of straining at stool, with the discharge of pus and small amounts of blood from the rectum. The dermatitis and the red tongue which she exhibited were typical of pellagra. Physical examination revealed a stricture of the rectum, not very marked, 4 cm. above the anus, which could be dilated without difficulty. There were large granulomatous lesions of both labia, the well-defined, indurated borders of which extended downward towards the anus from the mons veneris. The Wassermann reaction was negative and the Frei test ++. In addition to the routine treatment for pellagra, this patient received tartar emetic.

Case VIII. D. R., a negro female, aged twenty-six, complained of straining at stool and the discharge of pus and blood from the rectum. Physical examination revealed a tight stricture about 6 cm. from the anus, which d.d not admit one finger. The right labium was thickened and pendulous, and simulated a lipoma in appearance; this condition had been present for about two months. The Wassermann reaction was negative and the Frei test +++. Routine treatment was undertaken.

*For purposes of convenience the Frei reactions were arbitrarily graded as 1, 2, 3 and 4 plus, depending upon the intensity of the intracutaneous response.

Case ix. W. M., a negro female, aged forty-two, had been under treatment for rectal stricture for the last four years. A scar in the right inguinal region had been present since the incision of an abscess (probably a bubo) fifteen years before. In May, 1934, she had submitted to an operation for the repair of a rectovaginal fistula, the result of which was at least temporarily good. Physical examination revealed a stricture of the rectum several centimeters above the anus, which could be dilated to the size of a No. 7 bougie. There was a single firm anal tag present, and there were also small, fleshy excrescences on the posterior vaginal wall. The Wassermann reaction was negative and the Frei test +++. Routine treatment was undertaken.

Case x. E. C., a negro female, aged forty-six, had been treated by bi-weekly dilatations for the last three years for a rectal stricture associated with tenesmus and an occasional sanguino-purulent discharge. Physical examination revealed a ring of large, firm, cauliflower-like excrescences around the anus, a tight rectal stricture, and an indurated rectovaginal septum. The Wassermann reaction was negative and the Frei test ++.

NECROPSY REPORTS

We have had the unusual opportunity of observing at necropsy 5 cases of rectal stricture. Three of these cases were observed clinically as well as at autopsy; 2 are included in the 58 cases reported, and another came under our observation as this paper was being given its final revision. The post-mortem findings, which will be considered at length in a later communication, indicate clearly that the advanced or terminal stage of involvement of the rectum by the virus of lymphogranuloma inguinale is represented by the condition of chronic ulcerative stenosing proctitis and periproctitis, with multiple fistulae, which was observed in all the cases included in this report. The histology in all instances included essentially the same changes noted by Barthels and Biberstein,[17] which have already been mentioned but which might well be repeated here: destruction and ulceration of the mucosa, with a tendency upon regeneration to squamous metaplasia; infiltration of the muscularis by focal miliary accumulations of lymphocytes and plasma cells; dilatation of the lymphatics, with perilymphangitis (paravascular) and endolymphangitis; endarteritis and marked narrowing of the blood vessels; paravascular and perivascular infiltration of the periproctitic fat and connective tissue.

In 2 of the patients observed at necropsy (Case i and Case v) Frei-positive reactions were obtained during life. These cases (to the author's knowledge the first recorded instances of the kind)* are exceedingly important in that they furnish the link, hitherto lacking, between the clinical entity of rectal stricture due to lymphogranuloma inguinale, as identified by the Frei test, and the pathologic entity of chronic ulcerative stenosing proctitis. The latter has been recognized as a definite entity since 1897, though its etiology, until the factor of lymphogranuloma inguinale was introduced, had been entirely speculative and obscure.

Case i. This patient was a negro female thirty years old, whose history is related in Case iii of the group of abstracted cases already reported. The clinical diagnosis was rectal stricture with multiple fistulae-in-ano and "hemorrhoids." The Frei test was positive. Autopsy revealed a chronic ulcerative stenosing proctitis and periproctitis (Fig. 6). The cause of death was a superimposed acute ulcerative colitis involving principally the descending colon and sigmoid, which precipitated cardiac failure.

White mice were inoculated with infected tissue from this case, emulsions being prepared from fragments of the rectal mucosa, regional lymph nodes and fistulous tracts. The mice inoculated intraperitoneally showed no evidence of infection, while those inoculated intracerebrally developed a suppurative meningitis.

Case ii. This patient was the negro female, thirty-seven years old, whose history is related in Case i of the group of abstracted case

* Since this paper was written, two similar cases have been reported by Wien, Perlstein and Neiman. *Arch. Path.*, 19: 331, 1935.

reports. The cause of death was cardiac failure and the autopsy findings have already been listed. Tissue sections showed extensive second-

Fig. 6. Necropsy specimen. Chronic ulcerative stenosing proctitis and periproctitis in rectal stricture of three years' duration, with positive Frei reaction four months before death. (Case I.)

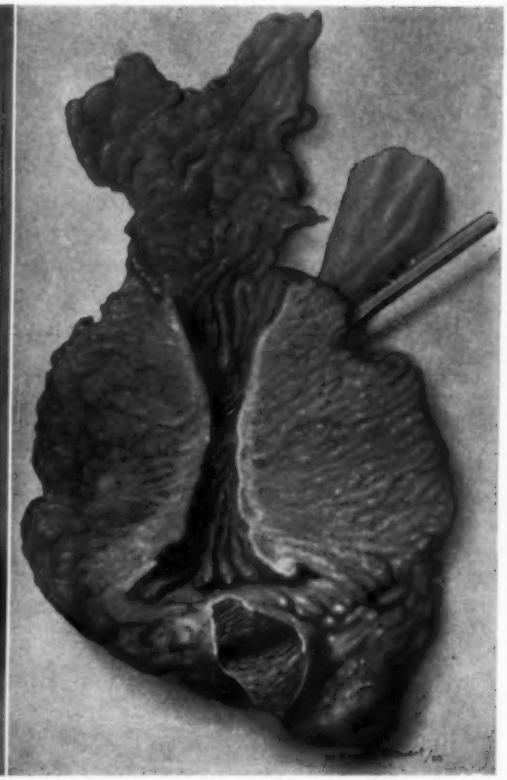

Fig. 7. Necropsy specimen. Chronic ulcerative stenosing proctitis and sigmoiditis with ileosigmoidal fistula. Cause of death generalized peritonitis, probably from perforation. (Case III in necropsy reports.)

ary infection and post-mortem change, but it was evident that the chronic inflammation in the rectum, sigmoid, vulva, vagina and other structures was non-specific in character. No plasma cell reaction could be made out, nor any endarteritis or endophlebitis suggestive of luetic granuloma. The tissues were obtained too long after death to permit animal inoculation.

Case III. A negro female, twenty-nine years old, was admitted with a diagnosis of pthisis pulmonis and hypertensive heart disease. The anatomic diagnosis at autopsy was chronic ulcerative stenosing proctitis and sigmoiditis with ileosigmoidal fistula, acute diffuse fibropurulent peritonitis, bronchopneumonia with pleuritis, and luetic aortitis. The cause of death was peritonitis, probably due to perforation of the sigmoid, and it was concluded that the walling-off of the perforation by a loop of ileum probably resulted in ileosigmoidal fistula (Fig. 7). The histologic study was unsatisfactory because of post-mortem changes, and the material was too old for animal inoculation.

Case IV. A negro female, twenty-nine years old, had been seized with upper abdominal pain six days before admission, preceded by dizziness and syncope. Abdominal pain had persisted since that time, together with distention and tenderness. Purgatives had been taken freely, but the bowel movements had been scanty since. Persistent vomiting had developed, and the whole story was compatible with the admission diagnosis of rectal stricture, with intestinal perforation and low-grade peritonitis. At autopsy the anatomic diagnosis was chronic ulcerative granulomatous proctitis with marked stenosis, decubitus ulcers of the sigmoid with perforation, and diffuse fecal peritonitis. The histologic study was unsatisfactory because of post-mortem changes, and for the same reason animal experiments were not undertaken.

Case V. A negro female, twenty-nine years old, sought hospitalization for the treatment

of fistula-in-ano and pellagra. She complained of a burning tongue, diarrhea, and discoloration and itching of the hands. Physical examination revealed a rectal stricture 4 cm. above the anus, barely admitting the index finger, together with "hemorrhoids" (the anal tags already described) and induration of the rectovaginal septum. The Wassermann reaction and the Frei reaction were both positive. The clinical diagnosis was pellagra and rectal stricture due to lymphogranuloma inguinale. Despite an appropriate diet to combat pellagra, the patient's diarrhea remained intractable, dementia developed, and she died two months after admission. Necropsy revealed chronic ulcerative, granulomatous proctitis with annular stricture. A severe secondary proctitis was present, as well as anal tags, periproctitis and fistulae-in-ano. The symmetrical dermatitis of the hands and feet was typical of pellagra. The cause of death was considered to be pellagra, with rectal stricture due to lymphogranuloma inguinale as the predisposing factor. This case is worthy of note not only because it is the second Frei-positive case of rectal stricture observed at necropsy but also because it emphasizes the frequent association of such strictures with pellagra to which we have already called attention.

SUMMARY

1. In this communication there are reported 154 cases of lymphogranuloma inguinale, all with positive Frei reactions, which were observed within a four-month period at the New Orleans Charity Hospital. The number of cases indicates that the disease is more prevalent in general hospitals with a large negro population than has hitherto been suspected. The disease is predominantly a disease of the negro race, but the white race is by no means exempt.

2. In the foregoing series are included 58 cases of inflammatory stricture of the rectum, in 55 of which the Frei test was positive. These cases are analyzed in some detail.

3. The evidence in favor of lymphogranuloma inguinale as the etiologic factor in nearly all cases of rectal stricture is briefly summarized.

4. A definite clinical picture of inflammatory stricture of the rectum is presented, and the associated lesions are analyzed.

5. The chief pathologic features of rectal stricture are presented, and its symptomatology, diagnosis and treatment are briefly considered.

6. Five cases of rectal stricture observed at autopsy are included in this communication. Three of these cases were observed clinically and represent, we believe, the first recorded instances of rectal stricture associated with lymphogranuloma inguinale which came to autopsy diagnosed as such. The findings in all 5 cases clearly indicate that the terminal stage of involvement of the rectum by the virus of lymphogranuloma inguinale is the pathologic entity of chronic ulcerative stenosing proctitis and periproctitis, the etiology of which has hitherto been obscure.

7. In 2 of the cases studied at autopsy positive Frei reactions were observed during life, and it is concluded that these important cases, which, so far as the author knows, are the first of the sort on record,* furnish the missing link between the clinical entity of rectal stricture due to lymphogranuloma inguinale and the aforementioned pathological entity.

REFERENCES

1. Cole, H. N. Lymphogranuloma inguinale, the fourth venereal disease. *J. A. M. A.*, 101: 1069 (Sept.) 1933.
2. Fournier, A. Quoted by Stannus.
3. Frei, W., and Koppel, A. Ulcus vulvae chronicum elephantiasticum (esthiomène) und sogennante Syphilôme ano-rectal als Folgeerscheinungen der Lymphogranulomatosis inguinalis. *Klin. Wchnschr.*, 7: 2331 (Dec.) 1928.
4. Bensaude, R., and Lambling, A. Quoted by Stannus.
5. De Gregorio, E., and Murúa, J. Quoted by Stannus.
6. Jersild, O. Quoted by Stannus.
7. De Wolf, H. F., and Van Cleve, J. V. Lymphogranuloma inguinale. *J. A. M. A.*, 99: 1065 (Sept.) 1932.
8. Bloom, D. Stricture of the rectum due to lymphogranuloma inguinale. *Surg. Gynec. Obst.*, 58: 827 (May) 1934.
[For Remainder of References see p. 153.]

*See footnote on page 124.

BENIGN STRICTURE OF THE RECTUM

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BENIGN stricture of the rectum is a relatively common disease, especially in the colored female. This paper is a report of 22 cases studied and followed in the Out-Patient Department of the Roosevelt Hospital for the last three years. Seventeen of these patients are colored women with an average age of thirty-five, three are white women and two men. I have not included stricture of the rectum resulting from some operative procedure or cases of congenital deformity or simple spasms of the sphincter ani.

Syphilis, gonorrhea and tuberculosis have long been emphasized as the principal causes of benign strictures of the rectum. Some authors have particularly stressed syphilis as the most common etiological factor, even going so far as to claim that an inflammatory stricture of the rectum is always syphilitic, even though the blood Wassermann reaction is repeatedly negative. Others have emphasized gonorrhea as being the most common cause, citing such evidence as the proximity of the rectum and vagina, bacteriologic proof that the gonococcus invades the rectum, the frequency in the young adult colored female, and the tendency of gonorrhea to cause stricture of the urethra. This evidence is all very inconclusive. In not a single one of this short series of 22 cases has it been possible to establish the etiological factor to be gonorrhea, syphilis or tuberculosis. Three of the patients had 4 plus Wassermann reactions and two, 1 or 2 plus reactions, but antiluetic treatment and iodides had no effect on the stricture in any of these 5 cases. Judging from case reports in the literature, I do not doubt that syphilitic stenosis of the rectum does occur, but I believe it to be relatively rare. Tuberculosis and gonorrhea are difficult to exclude in every case of the series, but in no case is it possible to establish either one of these diseases as the etiological factor of the stricture. Only 2 cases gave a history of the previous prolonged proctitis, pain and purulent rectal discharge, which one would naturally expect if either one of these infections were present in sufficient severity to produce a fibrous stricture of the entire rectal wall. Six of the 20 cases in women gave a history of some previous pelvic disturbance or treatment which might have been for a chronic gonorrheal infection, but in only 2 of these 6 was the history of gonorrhea proved. Both of the patients with a history of severe, prolonged rectal irritation gave a story very suggestive of a prolonged dysentery infection and it is possible that the rectal stricture is the result of this type of infection.

There is no doubt in my mind that nearly all of this series of cases, if not the entire series, are examples of the fourth venereal disease, lymphogranuloma inguinale, although absolute proof is lacking. The literature on this disease, which is mostly in French and German, has grown very extensive since it was first described in 1913 as a disease entity by Durand, Nicolas and Favre. The condition is apparently well known in Europe but knowledge of it among American practitioners has spread rather slowly. Many have never heard of this infection or confuse it with granuloma inguinale, which is an entirely different and unrelated disease entity.

Frei in 1925 described his intradermal test for the diagnosis of lymphogranuloma

inguinale, since known as the Frei test. Despite its crudeness, this simple procedure seems to be a reliable diagnostic guide that the disease is or has been present. It has done more than anything else to clear up the mystery of the etiology of benign stricture of the rectum. The original work of Frei and the description of the disease by French observers has been repeatedly confirmed, and is entirely corroborated by our findings in this series of cases.

The principal clinical facts of this fourth venereal disease are as follows: There is a primary lesion, almost always on the genitalia, where the fresh virus has been rubbed into the skin or mucous membrane by sexual contact. It may be herpetiform or a small inflamed papule. It may be multiple and sometimes there is a superficial ulceration. It heals without treatment in a few days. It is usually dismissed as a little herpes or pimple of no significance. It is painless, and if on the vaginal mucosa, almost always passes unnoticed. Six to fifteen days after the appearance of this primary lesion, the draining lymph nodes become involved in a very slowly progressive, almost painless, destructive, inflammatory process. In the male this inguinal adenitis runs a very prolonged chronic course, somewhat similar to tuberculous lymphadenitis. The group of swollen glands become matted together, in multiple areas necrosis and suppuration occur, the overlying skin becomes a dark red, almost purple color, and eventually, if not previously incised, multiple sinuses appear. I have had the opportunity to follow 2 such cases in the clinic, both in negro males. Both were thought to be at first chronic suppurative inguinal adenitis, complicating some abrasion or a non-specific local infection of the penis. The Wassermann reaction in both cases was negative. Culture from the pus in the glands was sterile for pyogenic organisms. Unfortunately I treated both cases before we were doing Frei tests. One of them, after dressing his glands for six months, disappeared from the clinic. The other eventually had a bilateral inguinal gland dissection with a preoperative diagnosis of tuberculosis. The pathological report on these glands was chronic inflammatory tissue, not tuberculous. On reviewing these sections, I find them to be quite typical of the pathological lesions of lymphogranuloma inguinale as described by the French. There is an intense infiltration of lymphocytic cells with multiple small areas of necrosis and suppuration. This patient I was able to recall recently, two and a half years after his operation. The inguinal region is now perfectly well except for the puckered scars. His Frei test was found to be strongly positive. I believe that both of these cases are typical of lymphogranuloma inguinale in the male. Undoubtedly many cases which now pass as chronic inguinal lymphadenitis, are examples of this fourth venereal disease. A Frei test should be done in such cases of chronic inguinal adenitis.

In the female the primary lesion is usually somewhere on the vaginal mucosa or labia. The lymphatic drainage of the lower vagina and vulva is to the inguinal lymph glands, and if the primary lesion is situated at the vaginal introitus, the disease may run in the female exactly the same course as it does in the male. More commonly the primary lesion in the female is inside the vagina where the lymphatic drainage is into the pelvis. Lesions on the cervix and high in the vaults of the vagina drain into the lymph nodes along the iliac vessels, but those lower down on the vaginal wall drain into the chain of lymph nodes alongside of the rectum in the hollow of the sacrum. The lymphoid tissue of the rectal wall itself becomes involved secondarily in this chronic, almost painless, destructive inflammatory process. The patient complains of few or no symptoms and presents herself for treatment in the late stages of the disease when she has a cicatricial stenosis of the rectum. The process starts as an infection of the lymph nodes around the rectum by the virus of the lymphogranuloma inguinale.

Eighteen of our 22 cases of benign rectal stricture gave a definite positive Frei reaction. The other four are doubtful or negative. In some of these the difficulty may be technical. We have had no false definitely positive reactions on control cases. The test is an intradermal injection. Pus from a typical lymphogranuloma inguinale gland is diluted about ten times with normal salt solution and sterilized by heat to 60°C. for two hours on one day and for one hour on the second day. This so-called antigen, if kept cold, keeps its potency for nearly a year. It is cultured to be sure of its sterility and is tested out on cases with a known positive Frei reaction and normal controls. One-tenth cubic centimeter of this material is injected intradermally into the skin of the forearm, making a small wheal exactly as one does in doing a Shick test. A positive case begins to develop a papule with a red areola within twenty-four hours. It varies very much in size and is larger on the second day. The result is read after forty-eight or seventy-two hours, as there is occasionally a false evanescent reaction which begins to disappear by the second day. In the negro the elevation and induration of the papule is more reliable than the inflamed areola. In a very positive case this papule may go on to a small area of necrosis and ulceration which may be two to four weeks in healing and may leave a permanent scar and pigmentation. The papule usually lasts at least a week, so that the reading is almost always either a definite positive or negative. This cutaneous allergy develops early in the disease and persists perhaps indefinitely after the disease is healed. There seems to be no question as to the reliability of this test provided one's antigen is potent. The extraordinary high percentage of patients with benign strictures of the rectum who show a positive Frei test, has been confirmed by nearly everyone who has tried it, and it is the principal evidence which is offered to prove that these strictures are due to the late results of infection by the virus of lymphogranuloma inguinale.

Many attempts have been made to improve the original antigen as described by Frei and a great deal of research has been done to establish the exact nature of the infective agent. It is undoubtedly a filterable virus. The disease has been artificially produced in man and monkeys. Injected intracerebrally in the monkey, it produces a fatal meningo-encephalitis which can be transmitted through repeated animals, each time producing the same disease entity. Emulsions of the brain and meninges of these animals, sterilized, diluted and prepared exactly as Frei did pus obtained from human glands, make an excellent antigen for the dermal test for the disease. Dr. Arthur Grace of the New York Hospital staff has been successful in transmitting the disease through many generations of mice by intracranial injection of the virus. The mascerated brain tissue of these infected mice makes an excellent Frei antigen. This will greatly simplify the source and preparation of Frei antigen, which is the principal difficulty at the present time in the study of the disease. Dr. Grace will undoubtedly soon publish his own report on this subject, as it promises to be a very important contribution.

There is a marked similarity in the history, symptoms and local findings in all of these 22 cases. None of them presented themselves to us for treatment until actual partial stenosis of the rectum had already occurred. We have not been able to watch the progress of the disease in its early stages. There is a case, not included in this series, on the medical ward at Roosevelt Hospital at the present time which seems to be in the active stages of the disease. He has a painless proctitis of severe grade and a strongly positive Frei test. The Frei test is so positive in this case that the nodule ulcerated and was a month in healing. We are all following the course of this patient with great interest. I have seen another case, not included in this series,

with a positive Frei test and a peculiar localized submucosal induration of the rectum which possibly is an example of the disease in an early stage. Frei antigen should be part of the equipment of every diagnostic laboratory and the test should be done in all cases of obscure chronic inguinal lymphadenitis and rectal strictures and indurations.

There is a similarity in the local lesions and symptoms of all these cases. Difficulty in moving the bowels, painful defecation and bleeding are the most common symptoms. Ribbon or pencil stools are a frequent but not universal story. The lesion begins not far from the sphincter and can be easily felt with the examining finger in all the cases. Some of them show only a narrow shelf or ring of scar tissue. From this the pathology varies to complete stenosis of the entire rectum and sigmoid portions of the colon. One such case came to autopsy from chronic intestinal obstruction even after a colostomy had been performed. Another patient is getting along fairly well with a permanent colostomy.

Many treatments have been advised. In the literature good results are claimed from injections of 1 per cent solution of antimony and potassium tartrate intravenously, *x*-ray therapy, intravenous injections of typhoid vaccine and subcutaneous injections of lymphogranulomatous antigen. We have had very little experience with these various methods of treatment. It would seem to us that they would be principally of value before the rectal stricture had occurred. We have limited ourselves largely to the mechanical dilatation of the stricture by bougies and colostomy in severe cases. In dilating with bougies it is important to be very conservative. If the bowels are kept soft with mineral oil, it is astonishing how small an opening in the rectum a patient can endure with apparent comfort and health. When this degree of dilatation has been obtained, the patient can be taught to pass frequently a bougie of sufficient size to maintain good bowel evacuation. It is not worth while to attempt dilatation beyond this point. It is certainly unwise to attempt to reestablish a normal lumen in the rectum by dilatation, as the damage which this causes does more harm than good. One must always be gentle as the possibility of perforation of the rectum must be borne in mind. One of our patients has a large rectovaginal fistula which is probably the result of bougies. This patient now has a permanent colostomy. One patient with a very narrow stricture has a very nice result from incision of the stricture and follow-up packings. We have not attempted other local surgery on these cases and the reports in the literature have not encouraged us to do so.

CONCLUSION

1. Eighty-one per cent of a series of 22 cases of benign strictures of the rectum showed a positive Frei test.

2. Lymphogranuloma inguinale seems to be the most common cause of benign stricture of the rectum, although it has not been proved.

3. In the more severe cases the patient requires a permanent colostomy but most of them can be kept comfortable for long periods with simple local dilatation. This must be done carefully and not beyond the minimum lumen required to maintain satisfactory bowel movements.

REFERENCES

Durand, Nicolas and Favre. *Bull. et mém. Soc. Méd. d'Hôp. de Paris*, 35: 274–288 (Feb. 6) 1913.

Frei, W. *Klin. Wchnschr.*, 4: 2148–2149 (Nov. 5) 1925.

DeWolf and Van Cleve. *J. A. M. A.*, 99: 1065–1071 (Sept. 24) 1932.

Stannus. A Sixth Venereal Disease. London, Baillière, Tindall & Cox, 1933.

SEPTIC JOINT DISEASE

REPORT OF FOUR CASES OF HIP JOINT INVOLVEMENT

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THE treatment of this appalling and severely disabling condition has passed through various and sometimes bizarre phases. That it has passed through various stages can readily be appreciated by studying the recent article by Inge and Liebolt in which a complete historical summary is portrayed. The author wishes to report 4 cases of acute suppurative involvement of the hip joint, one case treated by means of aspiration without the use of antiseptics and the remaining three treated by arthrotomy and drainage of the joint involved, with varying results as will be noted later. The author reports nothing novel in the treatment of this condition but presents the cases in an endeavor to emphasize the vicious nature of the disease.

In order to thoroughly understand and appreciate the severe nature of the condition, one has only to study the evolution of the treatment throughout the ages. This has been thoroughly covered by Inge and Liebolt, but will bear repetition. For the sake of brevity, the historical phases are divided into three cycles: (1) The period of mass amputation and wide incision into the joint for the purpose of drainage. To this period belong the works of Lowe, Wiseman, Astley-Cooper, Brodie, Fergusson and others as well as a more conservative treatment advocated during the Civil War by Buck. (2) To the second period which was ushered in in the late nineteenth and early twentieth century and proceeded up until the time of the World War, a somewhat newer concept of the treatment was offered. MacNamara advocated the use of drainage tubes following incision into the joint while Payr demanded functional maintenance as prima facie evidence of perfect end-results. It was Payr who differentiated between articular empyemata and capsular phlegmons demonstrating the more favorable prognosis of the former. In the treatment of the empyemata, Payr advocated small incision, closure of the joint capsule and early motion. In the case of phlegmons he advocated drainage by means of arthrotomy. (3) The third period which extends from the beginning of the World War to the present time. This period encompasses a mass of literature which advocates many and divers methods of approach: (a) The Willems treatment, which had for its basis the opposition of immobilization. Willems, in an effort to prevent ankylosis and muscular atrophy, advocated wide incision followed by immediate active motion. This treatment has been tried by many, notably the French surgeons Launay, Duval, Cotte, Depage and Delray and in this country Cotton and in England Everidge. (b) The use of a chemical disinfectant which was ushered in by the Carrel-Dakin method of treating infected wounds. A solution such as the 3 per cent phenol-camphor mixture of Chlumsky, iodoform and glycerin, 10 per cent iodoform-beta solution and lately rivanol has been used with varying results. The workers of this class are Kortzeborn, Cotton, Duguet, Fischer and Zillmer. (c) The treatment by means of aspiration with or without the injection of an antiseptic solution or bacteriophage. To this group belong the works of Kortzeborn and Hesse, LaPointe and Bazy, Miraillie,

Wiart and Thiery as well as the works of Blake who advocates repeated aspiration until resolution takes place when incision is indicated. (d) The work of Inge and Liebolt, who in a recent article advocate incision with the placement of intracapsular drains coupled with early motion and without the use of antiseptics.

From the foregoing data one can readily see that the treatment of this almost malignant condition has passed through various stages from the alpha of amputation to the omega of letting the condition run its course to hope for an ankylosis in the best possible position. In fact some surgeons advocate resection with the ultimate view of bony ankylosis as the *only* cure. The history also represents a retrogression of the treatment to the time of Brodie, who in 1840 advocated a wide opening into the joint at its most dependent portion.

In evaluating the results of various writers, one is forced to take into consideration various factors which have to do with the end-results, for instance:

(1) The etiology. Penetrating wounds such as those encountered in war and certain civil accidents are more difficult to cope with than a metastatic infection due no doubt to the trauma suffered by the cartilage and osseous structures.

(2) Age of the individual. Although this is a disease of the young, it is encountered many times in adults and because of the possible constitutional diseases as well as continual trauma encountered in everyday life, the resistance of a joint to infection may be lowered in the grown-ups.

(3) Site of involvement. The prognosis as concerns various joints differs greatly; for instance, the hip joint seems notorious in its inability to combat an infection without early bone involvement, leaving serious sequelae.

(4) Type and virulence of the invading organism as well as the resistance of the patient to the infection. The usual pus-forming bacteria (staphylococcus and streptococcus) present different problems as concerns end-results. The staphylococcus is not prone to cause an early ankylosis, while the streptococcus conversely often leads to an early bony ankylosis. For instance, Kortzeborn and Hesse found that the greater percentage of ankyloses occurred when the streptococcus was the offending organism. In one of the cases to be reported (Case 1), despite the severe infection with Staphylococcus aureus which caused complete destruction of the femoral head and neck, no sign of a productive nature, either bony or fibrous, occurred but instead a pseudo-arthrosis similar to that in the case reported by Stewart.

(5) Time interval between the acute invasion and treatment. This factor cannot be too well emphasized and seems to the writer to be the crux of the entire mode of treatment. In the series to be reported only one case was seen earlier than six days after the onset of symptoms and was the only case in which an excellent result was obtained.

(6) The question as to whether there is an early involvement of the bone. This factor is probably the most important as concerns end-results. For instance 10 cases reported by Inge and Liebolt showed involvement of the bone at the joint when an opportunity for treatment was instituted, and in all of the cases involved there were no excellent results; four of the cases went on to a bony ankylosis and one was an irreducible dislocation which was present when seen by these writers. The question as to osseous involvement at a joint is extremely difficult at times to decide, especially is it true in the hip joint where pathological changes take place early as well as early infection of the bone by means of extension from the cartilage or from the synovial membrane by means of the circulus articuli vasculosus. Phemister has shown that early involvement of the bone takes place because of early erosion of the cartilages of the opposing joint surfaces. If this early involvement of the bone is true, one is

put to a task in an endeavor to calibrate bone involvement by the roentgenogram in the early stages. Ghormley has pointed out that there may be early swelling of the synovial pouch and narrowing of the joint space, and advises roentgenograms of the opposite joint in the same position for the purpose of comparison.

CRITIQUE OF METHODS IN USE

From the foregoing discussion one quickly realizes the reason for the variance in the treatment and the end-results of different writers, and is confronted with the all-important question as to the routine to be followed in cases of joint involvement.

(1) Shall one follow the teachings of Blake who advocates early aspiration until resolution occurs when drainage may then be instituted? Blake draws a comparison between joint involvement and suppurative pleurisy and peritonitis. However, to compare a joint with its fine architecture and delicate anatomical parts which are subject to different changes when involved by some pus-forming bacteria to a serous membrane is beyond the realm of the imagination of the author.

(2) Shall one follow the teachings of those advocating disinfection of the joint either by aspiration or incision into the joint? This method has received quite a good deal of attention since the World War and as the use of it has not been applied by the author he is forced to shy at any evaluation of the method. Zillmer, based on the experience of the World War, advocates (a) mechanical and chemical disinfection of the joints, (b) suture of the capsule and (c) early active mobilization. He has lately reported a good result by means of operation and the use of rivanol. Some recommend the use of the phenol-camphor mixture of Chlumsky which produces a hyperemia, relieves pain and produces a mechanical dilating action. Kortzeborn and Hesse report 19 joints treated by aspiration, the use of Chlumsky's solution and early motion. Their results show good function in 21 per cent, 5 cases went on to ankylosis and 5 patients expired.

(3) Shall one follow the Willems treatment of joints involved in a purulent manner? This treatment necessitates heroic efforts on the part of the individual suffering with the condition. The near impossibility of cooperation on the part of patient suffering with this condition has caused it to be rather coldly received in this country. Willems reports 36 per cent failures in 11 cases of knee involvement. Everidge reports 60 per cent failures in 20 cases. DePage and Delray report 42 per cent failures in 31 cases. Duval 40 per cent failures in 5 cases, Cotte 100 per cent failure in 8 cases, Cotton 100 per cent failure in 2 cases. Launay reports 2 cases in which the treatment was successful. In the opinion of the writer, the work of Willems is important as regards the early active motion phase of his treatment. However, the pain and discomfort encountered on weight-bearing has caused it to be discarded by most surgeons and the institution of a somewhat more humane method of treatment.

(4) Shall one follow the treatment advocated by earlier writers, notably Brodie who advocated incision and drainage, Payre, MacNamara and Laewen who recommended deep incision for drainage of phlegmons and lately Inge and Liebolt who recommended arthrotomy with intracapsular drains? The last-named writers report 36 cases, 22 bacteriologically proved, in which excellent results were obtained in 14 cases (2 cases were aspirated with relief of symptoms). Five cases showed good results, one fair and two poor. Four cases were similar but were not bacteriologically proved. In these cases there were two with excellent results and two with poor results. Ten cases were complicated by infection of the bone and no excellent results were obtained.

All of the foregoing methods of treatment have been religiously advocated and on the various factors involved, as previously stated, depend the results which have

been obtained. The importance of evaluating end-results in very often lost sight of. The arbitrary fashion in which some report good results when motion is very often retained to a 10 to 20° angle while other authors report a poor result when 50 per cent motion is left often confuses what may be considered cures by some writers and failures by others. In evaluating the results in the 4 cases reported, the system described by Corscaden has been followed, with a second check on the extent of disability as estimated by McBride; for example, as concerns the anatomical, symptomatic, and functional results, 4 represents excellent results, 3 good and 2 fair, while anything less than 2 is a poor result. In order to arrive at an estimate as concerns function, the following factors have been used as a check of the Corscaden method (McBride).

	Per Cent
(1) Quickness of action	10
(2) Coordination of movement	20
(3) Strength	20
(4) Security	10
(5) Endurance	20
(6) Safety as a workman	10
(7) Prestige of physique	10
Grand total	100

For example, should the estimate reach 75 per cent, one would be forced to say that as regards function the end-result was 3 according to the Corscaden method.

CASE REPORTS

In the accompanying table is placed a summary which covers at a glance the evolution of the 4 cases. All cases were similar as regards symptoms and disability. The duration of symptoms differs materially, however. None of the cases showed bone involvement on macroscopic examination (physical and roentgenographic examination). However, that bone involvement was present seems most probable where the cases are examined retrospectively. In Case I the patient was treated by repeated aspirations (4) with the replacement of the amount withdrawn by air, in an endeavor to decrease the negative pressure in the joint, and then a large cannula was placed in the joint cavity by means of puncture and permitted to remain for one week. All other cases were treated by posterior incision into the joint with the placing of rubber tubing at its most dependent portion. The drains in these 3 cases were removed gradually and the time of removal depended upon the lessening in the amount of drainage as well as the improvement in the general condition of the patient, that is, lowering of the temperature, reduction in the white blood cell count, etc. All of the cases were treated by traction and passive motion was instituted early by means of an over-slung frame and pulley arrangement. This was begun as early as the first day following the institution of treatment. Active motion was instituted as soon as possible; in Cases II and IV active motion was possible the second day following operation. Weight-bearing was initiated as early as possible by means of a traction walking caliper. Joint space was maintained by this maneuver, the necessity for which was demonstrated by the work of Phemister who claims that pressure necrosis of the articular cartilages occurs early in purulent joints.

The matter of diagnosis is of great importance. In none of the cases was diagnosis correctly made prior to entrance into the hospital and the tentative diagnosis before orthopedic consultation was correct in only one case (Case III). A searching and complete history, physical and roentgenographic study coupled with the use of diagnostic puncture will usually lead to a correct conclusion. Hesitancy in the performance of a puncture seems widespread. The author can deduce no contraindication for this procedure. Certainly no harm can befall one if all the rules of asepsis are rigidly adhered to.

The etiology in all cases was hematogenous, the offending organism being Staphylococcus aureus in all cases. The diagnosis was arrived at by an evaluation of the

history, physical findings and diagnostic puncture. In no case was it possible to credit roentgenographic findings except to rule out other conditions, such as specific involvement (lues and tuberculosis).

Case 1. A. K., white male, aged thirty-seven, entered the hospital September 17, 1930. The entrance complaint was pain in the right hip extending down the leg and also referred to the back. The patient stated that five years previous to admission he had been told that he had a tumor of the testicle which was malignant. This was removed at a Clinic in 1926. Following this the patient was given deep roentgen-ray therapy. About one year after the removal of the testicle the patient incurred a devastating "*x*-ray burn" which involved the lower part of the abdomen, the groin, the testicle, the penis, the inguinal region, etc. This led to a severe stricture of the urethra which necessitated the performance of a suprapubic cystotomy. The patient was in bed for about one year and then got up in a wheelchair. He stated that he then walked around with the use of a urinal which was attached to a small cystotomy tube. About two months previous to admission to this hospital the patient had been treated in a neighboring city by a family physician by means of extension on the right leg. He complained that he had frequent chills, sweats, and believed that he had a high temperature. He stated that the pain was severe and that except for brief intervals he had remained in bed with extension applied to the right hip for the past two months.

On entrance into the Veterans' Administration Hospital, Milwaukee, the diagnosis of acute arthritis of the right hip was made.

Fig. 1.

Fig. 2.

Fig. 1. Case 1. Roentgenograph on admission to hospital.
Fig. 2. Case 1. Roentgenograph four and one-half years later showing absorption of femoral head and neck, with formation of pseudo-arthrosis.

The patient was seen by the Orthopedic Department on September 18, 1930. At that time the temperature was 104.5°F., pulse 120; white blood cells 14,580; polymorphonuclear leucocytes 89 per cent. The right thigh was

Fig. 3. Case 1. Degree of motion maintained.

in a flexion deformity of 40°, abducted 20°, the knee flexed 45°. Any attempt at motion caused extreme pain and muscle spasm. An

Fig. 4. Fig. 5.

Fig. 4. Case II. Roentgenograph on admission to hospital.
Fig. 5. Case II. Roentgenograph four years later showing absorption of portion of femoral head and formation of pseudo-arthrosis.

x-ray taken on that date was negative. (Fig. 1.) Diagnostic puncture revealed heavy, creamy pus and 40 c.c. were removed. Laboratory

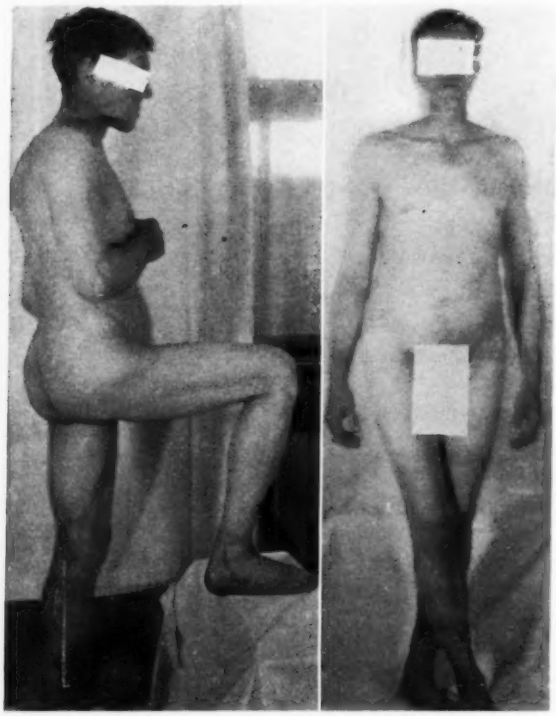

Fig. 6. Fig. 7.

Fig. 6. Case II. Degree of flexion maintained.
Fig. 7. Case II. Degree of adduction maintained.

analysis showed the organism to be Staphylococcus aureus. Traction was immediately applied as well as overhead slings attached to the leg. The hip was punctured on four succeeding days and the amount removed replaced with air in an endeavor to decrease the negative pressure in the joint and on the fourth day a cannula was placed by means of puncture into the joint. The drainage continued for one week and the cannula was then removed. The sinus tract caused by the cannula drained for two weeks and then healed. Motion was instituted by means of the overslung frame following the introduction of the cannula. The temperature and pulse returned to normal after four days and all pain disappeared. On September 30, thirteen days after admission, a traction walking caliper was applied and the patient was encouraged to bear weight. The caliper was dispensed with after two weeks and an apparent recovery occurred.

In January, 1933 the patient developed an empyema of the left chest for which a thoracotomy was performed. Twelve days following this operation symptoms occurred in the right hip. A puncture was immediately performed and 30 c.c. of pus were aspirated. The patient was again placed in a traction apparatus and puncture was resorted to for five successive days with the appearance of 10 to 40 c.c. of pus. Following the last puncture there was a complete cessation of symptoms. It was impossible to apply a caliper because of the chest condition. However, passive and active motion was instituted in bed and apparent recovery was obtained.

However, since that time there has been a slow and progressive absorption of the femoral head and neck. (Fig. 2.) There is severe shortening, no pain and fairly good motion in the hip, almost full flexion is present as well as full

adduction. Abduction is severely limited, however. (Fig. 3.) A stabilizing operation has been offered the patient but this has been declined as he considers the results at present sufficiently successful.

Fig. 8.

Fig. 9.

Fig. 8. Case III. Roentgenograph on admission to hospital.
Fig. 9. Case III. End-result: extra-articular arthrodesis.

Case II. M. F., white male, aged thirty-nine, entered the Veterans' Administration Hospital, Milwaukee, January 29, 1931. His entrance diagnosis was right sciatic neuritis.

The past history was irrelevant except that three weeks prior to admission the patient suffered a severe maxillary sinusitis. This was punctured and pus removed. Two weeks prior to admission the patient had sudden and severe pain in the right hip. He was treated by his family physician by means of external heat and sedatives. The patient experienced chills, sweats, etc. during the two weeks prior to admission.

The patient was seen by the Orthopedic Department on February 1, 1931. There was severe muscle spasm as well as flexion deformity at the hip. Temperature 103.6°F., pulse 140; white blood cell count 10,400; polymorphonuclears 95 per cent. *X*-ray was seemingly negative (Fig. 4). Diagnostic puncture was performed and thick creamy pus was obtained which proved to contain Staphylococcus aureus. Immediate incision was performed and the synovial sac found to be ballooned with pus. A moderate-sized rubber drain was inserted and sewed in place. Traction was applied and passive motion instituted the following day. Active motion was possible one day later. The drain was removed on the tenth post-operative day and walking traction caliper applied. The patient made an uneventful recovery and was discharged on March 8, 1932 as cured. A check-up on January 10, 1935 showed absorption of a portion of the head of the femur (Fig. 5). Motion was present to full flexion, full extension, full adduction and with abduction limited severely with 1¼ inch shortening. (Figs. 6 and 7.)

Case III. A. F., adult male, aged forty-two, entered the Veterans' Administration Hospital on January 30, 1932. The entrance diagnosis was septic arthritis of the left hip. The patient complained on admission of severe pain in the left hip of three weeks' duration. This was accompanied by chills, sweats, etc. One month prior to admission the patient had all of his teeth extracted because of a severe oral infection. On admission the temperature was 104°F. Pulse 140; white blood count 9800; polymorphonuclears 75 per cent. There was severe pain and muscle spasm on any attempt at motion of the left hip. The *x*-ray was seemingly negative (Fig. 8). No deformity of the hip was present, the leg being in full extension. Diagnostic

puncture was performed and thick creamy pus obtained. Immediate incision was performed with evacuation of a great amount of pus. An intracapsular drain was placed and traction applied. Motion was attempted early. However, the patient complained severely of pain and no cooperation could be secured. The drain was removed in twelve days and a walking traction caliper was applied. The patient steadfastly refused to carry out instructions and no amount of encouragement could change his attitude. He was discharged March 5, 1932 at which time he still complained of pain. However, excellent motion was retained and negative *x*-ray findings were present.

FIG. 10.

FIG. 11.

FIG. 10. Case IV. Roentgenograph on admission to hospital.
FIG. 11. Case IV. Roentgenograph three years later; normal joint.

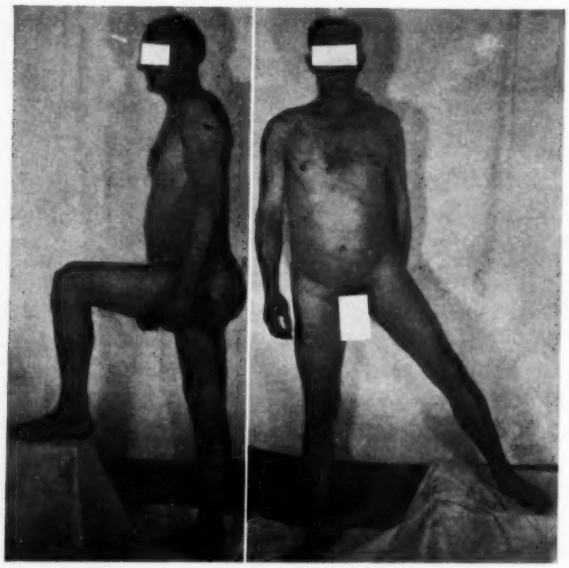

FIG. 12.

FIG. 13.

FIG. 12. Case IV. Excellent degree of flexion maintained.
FIG. 13. Case IV. Excellent degree of abduction maintained.

The patient re-entered the hospital December 7, 1932 complaining of pain in the hip and inability to bear weight. There was no deformity present but severe restriction of motion as follows: Flexion limited 125°, extension limited 90°, abduction limited 30°. The *x*-ray revealed a narrowing of the joint space with early erosion of the cartilage and productive changes. Diagnostic puncture revealed no pus. Temperature and laboratory analysis were normal. Due to the length of disability and continual pain, the proposition of an arthrodesis was broached to the patient. This was readily assented to and on January 4, 1933 an extra-articular arthrodesis by the Hibbs-Hass method was performed. This was successful and the patient made an uneventful recovery. (Fig. 9.)

CASE IV. A. P., adult male, white, aged thirty-nine years, entered the Veterans' Administration Hospital February 23, 1932. Entrance diagnosis was acute lumbar myalgia. The patient complained of severe pain in the right hip and back extending down toward the knees of five days' duration. Two weeks prior to admission the patient suffered a severe follicular tonsillitis and when first seen by the Orthopedic Department there was severe pain in the right hip on motion accompanied by muscle spasm but no deformity. The temperature was 105°F.; pulse 160; white blood count 13,400; polymorphonuclears 89 per cent. *X*-ray was negative (Fig. 10). Diagnostic puncture revealed heavy, creamy pus. Immediate incision with evacuation of a great deal of pus was performed with the insertion of a drain. Early motion was instituted and the drain removed on the tenth

postoperative day when a walking caliper was applied. An uneventful recovery occurred and the patient was discharged March 21, 1932. A recent check-up January 10, 1935 shows normal *x*-ray findings (Fig. 11) and excellent motion (Figs. 12 and 13).

SUMMARY AND CONCLUSIONS

1. Four cases of suppurative involvement of the hip joint are reported with their end-results as well as a review of methods used by various surgeons.

2. End-results are portrayed, only one case showing an excellent result.

3. Two cases resulted in pseudo-arthrosis following absorption of a portion of the head in one and the entire head and femoral neck in another, due probably to a vascular insufficiency with possible bone involvement during the acute stage as well as after all activity seemed to have ceased.

4. Certain factors are noted as having a bearing on the end-results, foremost of which are the time interval before treatment is instituted and the question as to bone involvement.

5. One case was treated by puncture with the insertion of a cannula for drainage purposes and 3 cases were treated by incision and drainage by means of rubber tubes.

6. Possibly the best treatment is early and complete evacuation of pus from the joint cavities. Arthrotomy with drainage seems to be the method of choice and the institution of motion is all important as an effort to combat poor end-results.

7. The prognosis in these cases is extremely grave and guarded. Two cases (Cases I and II) seemed to have a good end-result immediately following treatment but after a year or two had elapsed a rather poor result was obtained.

Table I
SUMMARY OF CASES

Case	Joint	Duration of Symptoms	Cause	Entrance Diagnosis	Organism	Treatment	Result	Factors Affecting Result	End-result
I	Rt. hip	60 days?	1. Urinary bladder 2. Empyema of chest	Acute arthritis	Staph. aur.	Aspiration with insertion of cannula	Destruction of femoral head and neck (pseudo-arthrosis)	Bone infection? Recurrence	Pseudo-arthrosis 0–4–1
II	Rt. hip	2 weeks	Sinusitis	Sciatic neuritis	Staph. aur.	Incision with placement of drain	Absorption of portion of femoral head (pseudo-arthrosis)	Bone infection? Possible absorption due to vascular involvement	Pseudo-arthrosis 0–4–1
III	Lt. hip	3 weeks	Oral infection	Septic arthritis	Staph. aur.	Incision with placement of drain	Painful joint necessitating arthrodesis	Secondary arthritis	Extra-articular arthrodesis 0–4–0
IV	Lt. hip	5 days	Throat follicular tonsillitis	Lumbar myalgia	Staph. aur.	Incision with placement of drain	Excellent	Early treatment	Normal joint 4–4–4

ADDENDA

Since the completion of the article, a manuscript concerning a symposium upon the subject of Knee Joint Involvement has come to hand. This symposium, by a group of English surgeons, namely, Mitchiner, Ellis, Butler, Slesinger, Girdlestone, Clarke and Fairbank, presents their methods of attacking suppurative arthritis of the knee joint. Mitchiner reports 17 cases, none of which was due to a penetrating wound of the joint. Six were caused by extension from a nearby staphylococcic osteomyelitis. He recommends drainage by lateral incision anterior to the biceps tendon followed by extension and the application of a plaster cast with weight bearing for three months. No early motion is encouraged. Of the 17 cases presented, amputation was performed in 3 and death occurred in 2. Good outcome is evaluated by the author (Mitchiner) if 60 per cent flexion is maintained. Ellis decries the fact that many surgeons trust the bactericidal function and power of serous membranes as is often done when comparing the serous membranes of the

abdominal cavity to that of the synovia of joints. He states that inasmuch as the synovial fluid nourishes the articular cartilages, this is very frequently lost by continuous washing out of the joint and he states that very often ankylosis may be the result of this type of procedure. He also advocates drainage by means of two long incisions on either side of the patella. Butler reports 20 perforating wounds of the knee with only 3 subsequent suppurative involvements. He makes the statement that the synovial fluid is bactericidal when fresh but when old is an excellent culture medium. Therefore, he advocates early aspiration and free incision should pus be found present. Ankylosis resulted in about one-third of Butler's cases, in another one-third good motion was obtained, in the remainder the results ranged from fair to poor. Girdlestone advised repeated aspirations without washing of the joints followed by extension. Slesinger states that the most important point is to arrange for the institution of motion early. He states that this can be done if there is sufficient extension to permit the joint surfaces to separate. Clarke states that in the early stages some motion of the knee is possible and this may delay diagnosis, unless puncture with examination of the fluid is performed. He states further that repeated aspirations or incision is advisable depending upon the local and general progress of the condition. Clarke also advises early active motion. He reports 20 cases, full motion resulting in 10, partial motion in 4, ankylosis in 4 and death in 2. Fairbank opens the joint widely by two anterior and two posterior incisions; he reports no cases.

REFERENCES

1. Blake, J. A. Treatment of acute pyogenic joint infections. Am. J. Surg., 39: 81, 1925.
2. Brodie, B. Observations on Diseases of the Joints. Ed. 4, London, 1840.
3. Buck. History of the Civil War. Prisons and Hospitals. Comp. by F. T. Miller. *Rev. of Rev.*, Vol. 7, 1912.
4. Corscaden, J. A. Follow-up system of the Presbyterian Hospital. *Med. & Surg. Rep. Presbyterian Hosp. N. Y.*, 10: 53, 1918.
5. Cotte. Quoted by Duguet.
6. Cotton, F. J. Disinfection of septic joints. *Boston M. & S. J.*, 74: 779, 1916.
   Infections of bones and joints. *Surg. Gynec. Obst.*, 31: 254, 1921.
7. DePage and Delray. Quoted by Duguet.
8. Duguet, M. Etat actuel de la question du traitement des arthrites purulentes. *Arch. de Méd. et Pharm. Mil.*, 78: 1, 1923.
9. Duval. Quoted by Duguet.
10. Everidge, J. New method of treatment for suppurative arthritis of the knee joint. *Brit. J. Surg.*, 6: 566, 1919.
    Mobilization treatment of knee joints. *Proc. Roy. Soc. Med.*, 12: 10, 1919.
11. Fischer, A. W. Indikationen und Erfolge des geschlossenen Behandlung von Gelenkeiterungen. *Klin. Wchnschr.*, 2: 1223, 1923.
12. Ghormley, R. K. Pathologic changes in diseases of joints. *Am. J. Roentgenol. & Rad. Therap.*, 29: No. 6, 1933.
13. Ghormley, R. K., and Brav, E. A. Resected knee joints. *Arch. Surg.*, 27: 465, 1933.
14. Inge, G. A., and Liebolt, F. L. The treatment of acute suppurative arthritis. *Surg. Gynec. Obst.*, 60: 86, 1935.
15. Kortzeborn, A., and Hesse, F. Behandlung und Erdausgaenge der unspezifischen eiterigen Entzuendungen der groszen Gelenke. *Arch. f. klin. Chir.*, 164: 95, 1931.
16. Laewen, A. Zu operativen Behandlung schwerer Knielenkseiterungen. *Deutsche Ztschr. f. Chir.*, 200: 516, 1927.
17. LaPointe, A., and Bazy, L. A propos du bacteriophage. *Bull. et. mém. Soc. nat. de chir.*, 57: 575. 1931.
18. Launay. Quoted by Duguet.
19. Lowe, P. A. Discourse on the Whole Art of Chirurgerie. Ed. 3, London, 1634.
20. MacNamara, C. Lectures on Diseases of Bones and Joints. Ed. 2, 1881.
21. McBride. Estimating the extent of disability. *Internat. Clin.*, 2: 206, 1934.
22. Miraillie, C. Sur en cas d'arthrite gonococcique gueri par injections locales de bacteriophage anti-staphylococcique. *Bull. et mém. Soc. nat. de chir.*, 57: 871, 1931.
23. Payr, E. Verlauf und Behandlung von Gelenkeiterungen. Leipzig, Vogel, 1916.
24. Phemister, D. B. Effects of pressure on articular surfaces in pyogenic and tuberculous arthritides and its bearing on treatment. *Ann. Surg.*, 80: 481, 1924.
    Changes in the articular surfaces in tuberculous and pyogenic infections of the joints. *Am. J. Roentgenol. & Rad. Therap.*, 12: 1–14, 1924.
25. Stewart. Pseudo-arthrosis following suppurative arthritis. *Ann. Surg.*, 99: 515, 1934.
26. Thiery, P. Sur le bacteriophage. *Bull. et mém. Soc. nat. de chir.*, 57: 655, 1931.
27. Wiart, P. A propos du bacteriophage. *Bull. et mém. Soc. nat. de chir.*, 57: 928, 1931.
28. Willems, C. Treatment of purulent arthritis by wide arthrotomy followed by immediate active mobilization. *Surg. Gynec. Obst.*, 28: 546, 1919.
29. Wiseman, R. The Severall Chirurgical Treatises. London, 1676.
30. Zillmer. Welche Lehren ergeben sich aus dem Erfahrungen des Weltkrieges hinsichlich der Behandlung von Schussgelenksverletzungen und Friedensgelenksverletzungen? *Veröffentl. Heeressan. Wes.*, 87: 5, 1932.
31. Mitchiner, P. H., Ellis, V. H., Butler, R. W., Slesinger, E. G., and others. A discussion on acute suppurative arthritis of the knee joint. *Proc. Roy. Soc. Med. Lond.*, 26: 1279, 1933.

TREATMENT OF

UNIMPACTED FRACTURES OF THE SURGICAL NECK OF THE HUMERUS*

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IN unimpacted fractures of the surgical neck of the humerus, the resulting displacement of fragments is such that reduction is usually quite difficult. As a result of muscular attachments, the head or upper fragment is abducted and externally rotated, while the lower fragment or shaft is drawn into the axilla. This is the usual displacement of fragments, but many variations occur. Due to injury to the muscular attachments and the capsule of the shoulder joint, the head often assumes the most bizarre positions. Comminution of the head leads to additional complications. It is this latter group of cases which we wish to discuss, giving methods of closed reduction with presentation of case reports.

At the Cincinnati General Hospital it is our custom with these cases to use balanced humeral skeletal traction. (Fig. 1, A and B.) The apparatus is composed of a Thomas splint with a forearm upright, and traction is obtained from the elbow, which is flexed at 90°. Formerly a swathe was placed around the forearm near the antecubital fossa for traction, but due to discomfort to the patient, inability of the skin to withstand sufficient traction, and edema of the forearm and hand from pressure on the antecubital vessels, this has been abandoned. Further, the swathe did not prevent sagging of the arm in the Thomas splint. At present more efficient results are obtained by the insertion of a small Steinmann pin through the olecrenon. This is done under procaine infiltration anesthesia without discomfort to the patient. Care is, of course, taken to avoid the ulnar nerve during insertion of the pin. The Steinmann pin is of such length that its stirrup rests on the Thomas splint, thus supporting the arm in the apparatus. The entire traction device is balanced from an overhead frame so that it moves with the patient and no axillary pressure results. It has been found that by varying the angle of abduction of the arm, some of the more difficult types of the fracture under discussion can be satisfactorily reduced. The optimum angle is usually 45°, but due to the numerous variations in the position of the head, this angle has to be determined for each individual fracture.

After reduction, this method of traction is maintained for three weeks and is then followed by strapping the arm to the chest wall by means of adhesive. A very satisfactory fixation is made by applying a Velpeau bandage over the adhesive and overlaying this with crinoline. Immobilization in this manner is maintained from one to two weeks and is followed by active and passive motion of the shoulder.

We would like to report several cases of the more unusual types of fracture of the surgical neck of the humerus treated by variations of this method of traction.

CASE 1. No. 35096. J. P., a white man, aged fifty-one, was admitted to the Cincinnati General Hospital on January 29, 1935, following a fall down a flight of stairs. In attempting to break the fall he struck on his right hand. He felt severe pain in his right

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shoulder and was unable to use his right arm. On examination the arm was held in abduction at an angle of about 40°, and prolongation

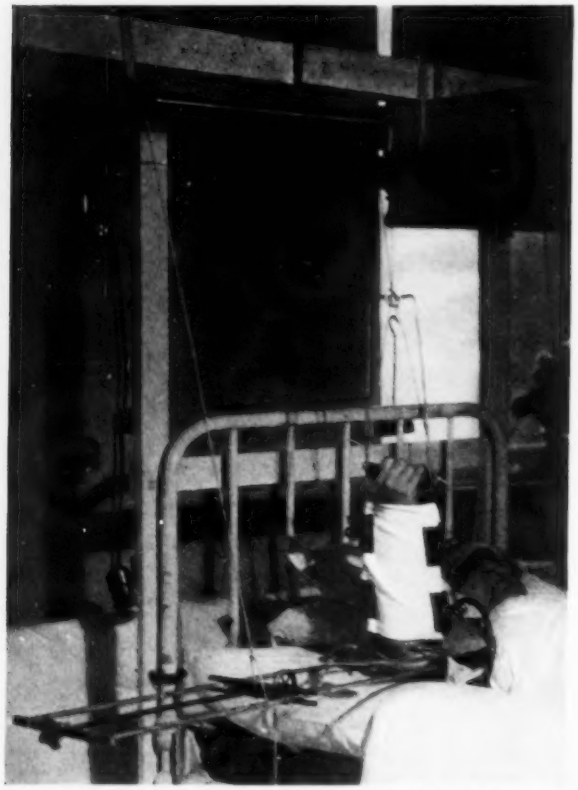

FIG. 1A. Balanced humeral traction with Steinmann pin through olecranon. Note method of balancing apparatus from overhead frame.

of the axis of the shaft of the humerus passed through the right eye. The glenoid fossa was thought to be empty, and the head was lying in the position of an anterior dislocation. Crepitation was, however, present. Roentgenograms (Fig. 2) showed a fracture of the surgical neck of the humerus with comminution of the head. The anterior half of the head was dislocated anteriorly and the shaft was driven up between the comminuted fragments. The patient was immediately placed in balanced humeral traction using a Steinmann pin in the olecrenon. After separation of the fragments by traction for twenty-four hours, 20 c.c. of 2 per cent procaine were injected into the hematoma and by direct pressure the dislocated anterior half of the comminuted head was returned to the glenoid fossa. Roentgenograms (Fig. 3) showed the resulting reduction to be satisfactory. The patient has since made an uneventful recovery with a return of satisfactory function.

CASE II. No. 35749. J. B., a white man, aged forty-seven, was admitted to the Cincinnati General Hospital on February 13, 1935.

FIG. 1B. Close view of Figure 1A. Steinmann stirrup rests on Thomas splint to prevent sagging of arm.

Eight hours previously he had fallen down a flight of steps, striking directly on his left shoulder. Examination of the left shoulder revealed marked swelling and ecchymosis extending down to the region of the elbow. No gross deformity was noted; however, crepitation, abnormal mobility, and Stimson's sign were present. A diagnosis of fracture of the surgical neck of the humerus was made. Roentgenograms (Fig. 4) confirmed this diagnosis with the typical displacement of fragments. Attempt at manipulative reduction under procaine infiltration anesthesia was unsuccessful. The arm was then placed in balanced humeral traction at an angle of 45°, using a Steinmann pin inserted through the olecranon. After twenty-four hours roentgenograms revealed that the shaft was still pulled into the axilla. The angle of abduction was then decreased to about 15° and sufficient weight applied to separate the line of fracture. This attempt at reduction was also unsuccessful as the shaft was still displaced medially. With the arm in the foregoing position and the fragments separated by excessive traction, a swathe was then placed around the arm as high in the axilla as possible and lateral traction applied (Fig. 5). After six hours roentgenograms (Fig. 6) showed the shaft to be in relatively good position but with the fragments separated. All weight was then removed from the humerus and by direct blows on the olecranon the fracture was

FIG. 2. Case I. Roentgenogram on admission, showing fracture of surgical neck of humerus with comminution of head. Anterior half of head is dislocated anteriorly and shaft is driven up between comminuted fragments.

FIG. 4. Case II. Roentgenogram on admission showing fracture of surgical neck of humerus with usual displacement of fragments. Head is abducted and externally rotated and shaft is drawn into axilla.

FIG. 3. Case I. Roentgenogram after application of balanced humeral traction. Anterior dislocated half of comminuted head has been returned to glenoid fossa.

FIG. 5. Case II. Photograph showing balanced humeral traction with arm abducted to an angle of 15°. Note swathe placed high in axilla for lateral counter-traction so as to pull shaft out of axilla.

impacted. The apparatus was then removed from the arm, which was immobilized by adhesive strapping to the chest wall. The

Fig. 6. Case II. Roentgenogram after application of lateral countertraction. Fragments are slightly separated from excessive traction.

patient has since made a satisfactory recovery with a return of 70° of abduction (ten weeks).

The following case is cited to show additional advantages of this type of traction without emphasis on the reduction:

Case III. No. 37243. P. J., a colored boy, aged sixteen, came into the Hospital on March 18, 1935, as a result of an automobile accident. On admission he was in severe shock with marked respiratory distress. Examination revealed a fracture of the surgical neck of the right humerus, multiple fractured ribs (crushed chest) on the left with hemothorax and subcutaneous emphysema, and a fractured pelvis. The patient was treated for shock in the usual manner, but due to respiratory distress Fowler's position and an oxygen tent were necessary. The left chest was strapped with adhesive and the right arm was temporarily strapped to the lateral chest wall. On the fourth day after injury the right arm was placed in balanced humeral traction using a skeletal pin through the olecranon. Mid Fowler's position was maintained after the application of traction.

This case illustrates the ability to use our method of reduction when Fowler's position is necessary.

DISCUSSION

We feel that this method of reduction of fractures of the surgical neck of the humerus has decided advantages over the methods more commonly used. (1) It is readily applied and reduction accomplished without the use of general anesthesia; (2) it allows for easy change and correction of position by simple adjustment of the various angles of traction; (3) it permits lateral countertraction when indicated; (4) manipulation of the fragments may be done without removing the traction apparatus; (5) it can usually be employed when the physical contour of the patient or associated injuries make it difficult to use any other method; (6) it is comfortable for the patient; (7) it can be used in cases where Fowler's position is necessary; (8) lastly, reduction of the fracture is more easily accomplished.

NEW TREATMENT OF

ACUTE OSTEOMYELITIS

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OSTEOMYELITIS is an acute infective disease, usually caused by Staphylococcus pyogenes aureus. The symptoms are characterized by pain, swelling, induration, elevation of temperature, increase in the number of leucocytes in the blood, and usually some limitation of motion in the nearest joint. *X*-rays are negative at first, but later show stripping of the periosteum from the bone, and still later sequestration. Anyone who has had experience in treating this disease is convinced there is something radically wrong with our present methods.

First, let us briefly survey the treatment of chronic suppurating wounds, as that is the foundation for the treatment of acute osteomyelitis. Boiling oil was the common treatment for suppurating wounds until Paré discovered that better results were obtained from the use of a mixture containing oil of roses and turpentine, as this did not cause pain or irritate the patient.

Lister also recognized the fact that pain and frequent dressing, which caused pain, played an important part in promoting suppuration, and consequently he left the wounds alone, simply covering them with gauze saturated in a paste containing one part carbolic acid and four parts shellac. This was done to prevent germs entering from the air, as it was believed at that time that this was the only mode of entry.

Markoe, who introduced Listerism in America, did not fully understand Lister's theories, and consequently the patient was again returned to the torture chamber by the introduction of tubes and frequent painful dressings.

Carrel and Dakin emphasized the need of preventing pain, and care in preventing injury to the wound. Their treatment was successful, but fell into disuse because it could only be carried out by trained operators.

It remained for Orr in his work on osteomyelitis to reestablish the Lister idea in a modified way. He conclusively demonstrated that wounds cleared of sequestra and packed with vaseline gauze would heal more rapidly than wounds constantly dressed. Plaster was applied to prevent pain, and the recuperative power of the patient was allowed to do the rest. Vaseline, of course, had no effect on the germs, but it did prevent the packing from adhering to the surrounding tissue it was gradually extruding from the wound, allowing healing from the bottom. Here again, pain was eliminated, and also the fear of the "agony wagon," as the dressing cart was familiarly known.

Baer demonstrated the same principle in another way when he planted maggots in the wound. These kept the wounds open until they healed from the bottom without causing pain or fear.

The effect of pain on the patient was again demonstrated during the Great War. Sixty per cent of those wounded in the thigh died during the early days of the conflict. This mortality rate was later reduced to 12 per cent by the simple expedient of applying a splint before moving the patient.

As pain and fear played an important part in prolonging suppuration in chronic osteomyelitis, so will they play an important part in prolonging an acute osteomyelitis into a chronic osteomyelitis.

Acute osteomyelitis is caused by germs carried through the blood stream and deposited under the periosteum. Here they multiply and form an abscess which gradually enlarges, stripping the periosteum from the bone. The underlying bone dies, forming a sequestrum. There may be some question about this statement, but as the earliest *x*-ray evidence shows stripping of the periosteum from the bone, this is undoubtedly the mode of onset.

Up to the present time, the accepted treatment of acute osteomyelitis has been incision and drainage. This is really like stabbing the patient in the back. Operation is not merely useless, it is positively detrimental to the patient. Nature has surrounded the infection with a solid wall of defense, and any incision through this wall simply breaks down the ramparts Nature has taken such care to erect. A general will allow his front lines to be destroyed, but never the rear lines. Nature also allows the front lines to be destroyed, but saves the rear lines. If forced to, she makes a gradual retreat until the surface is reached. But at all times she has complete control of the situation.

Incision opens up new areas for infection, and also leaves an open wound which may become contaminated because it is impossible to keep an open wound sterile. We have long since stopped operating on tuberculous abscesses because of the secondary infections which developed when they were opened. No one would operate on a boil until it had formed a head. Then, why operate on this condition which is much more serious than either of the others?

Now let us trace the cause of acute osteomyelitis. Germs cannot live in normal blood; otherwise we would be constantly subject to infection from contusions, cuts and scratches, because there are germs present in our skin at all times. Something must first happen to the blood, or the germs would be immediately killed and could not be carried to the point where the disease develops. As fear, worry, anger, fatigue, and such things prolong the infection, they must also play a part in starting the disease. We know that these conditions affect digestion. When digestion is interfered with, food putrefies in the intestinal tract. The poison from this putrefied food is absorbed into the blood stream, lowering the germicidal qualities of the blood. If we are going to overcome the infection, we must remove as quickly as possible the poison which has made the infection possible, and must prevent more poison from entering the intestinal tract.

The patient should be put on a liquid diet. The intestinal tract must be thoroughly evacuated. Pain should be relieved by the application of a plaster or splint, controlling the joint above and the joint below the disease. The patient must be assured that nothing radical is going to happen to him.

In this series of 20 cases, there have been no deaths, although there are 4 infants included in this report and the death rate of infants, according to Kennedy, is 70 per cent. All patients except one have made an uneventful recovery. The disease has not recurred in the limb so treated, although recurrence is very common in this disease. Of the 20 cases, 7 healed without abscess formation. In the other 13 cases, the abscess opened spontaneously. Only one of these patients had a positive blood culture, and it did not show positive until after the first operation. In the remaining 12 cases blood culture was negative.

CASE REPORTS

Case 1. A. C., male, aged fifteen. May 5, 1931.

The patient had had pain in the right knee for the past three weeks following a long bicycle ride. The temperature rose to 104°F. and fell to 100°F. in the morning. His head ached at first; he now complains of pain in the right groin.

Examination: There was marked thickening of the right leg above the knee; pain on pressure over the lower two-thirds of the leg, some flexion deformity, some redness and

induration. The general condition was poor. *X*-ray showed some elevation of the periosteum in the lower third of the femur.

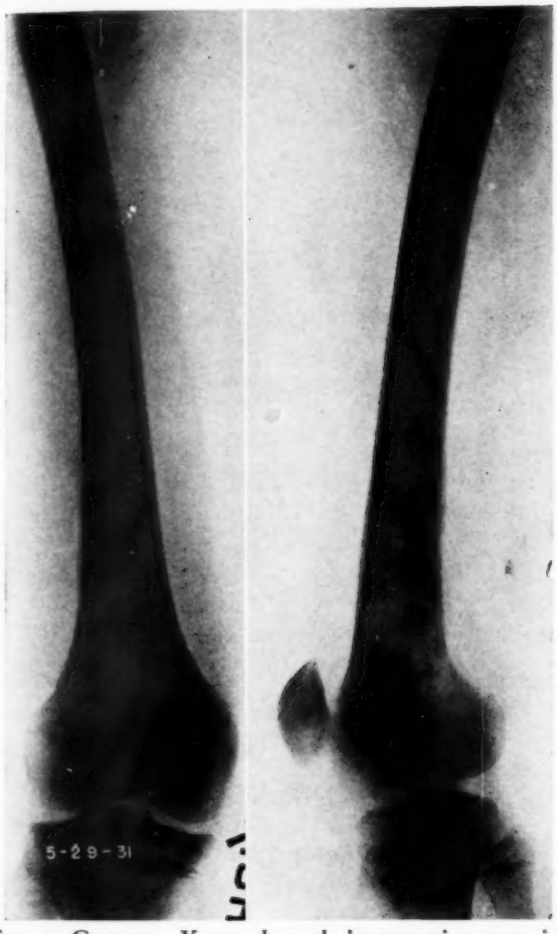


Fig. 1. Case III. *X*-ray showed degenerative area in lower end of femur with sequestrum.

Blood count: erythrocytes 5,000,000; leucocytes 13,000; hemoglobin 70 per cent; polynuclears 78 per cent.

The leg was put at rest. Pain was immediately relieved and the swelling subsided. The general condition improved.

Course: June 1, an *x*-ray showed a small piece of dead bone lying over the external condyle about ½ inch above the epiphysis. The plaster was removed. No pain was noted. July 14, *x*-ray showed the sequestrum very much smaller. February 8, 1932 there was no sign of active disease.

Case II. J. L., male, aged two years. September 21, 1929.

Two days before the boy caught his hand in a wringer, and broke the skin on the forearm.

Examination showed a small wound on the outer side of the forearm. The entire arm and hand, from fingers to shoulder, were swollen to double their size. Marked induration was present. The general condition was poor. The

Fig. 2. Case III. Final *x*-ray showed complete regeneration of femur. Sequestrum had been absorbed.

child was very toxic. He was removed to the hospital.

Blood count: erythrocytes 2,200,000; leucocytes 12,000; hemoglobin 48 per cent; polynuclears 70 per cent.

A splint was applied to the arm. Temperature was 103°F.

Course: September 22 and 24 he was given a 4 oz. blood transfusion. September 30 the swelling in the arm had slightly subsided. October 4 a fluctuating mass developed over the carpal bones. October 10 an abscess was discharging through the original opening of the forearm. The swelling was slowly subsiding. October 24 the abscess closed. November 1st he was discharged cured. No further disturbance was reported.

Case III. E. G., male, aged twelve and one-half years. September 7, 1933.

He gave a history of having been hit with a baseball six weeks previous. Since then he had had pain in the right leg. He was unable to straighten his leg.

Examination: The lower half of the right thigh was very much thickened and indurated. There was pain on pressure over the entire

area. The knee was held flexed to 125°. Temperature was 101°F.

Blood count: erythrocytes 5,000,000; leucocytes 16,300; polynuclears 68 per cent.

X-ray showed the periosteum elevated for about 3 inches over the middle third of the femur. Plaster was applied.

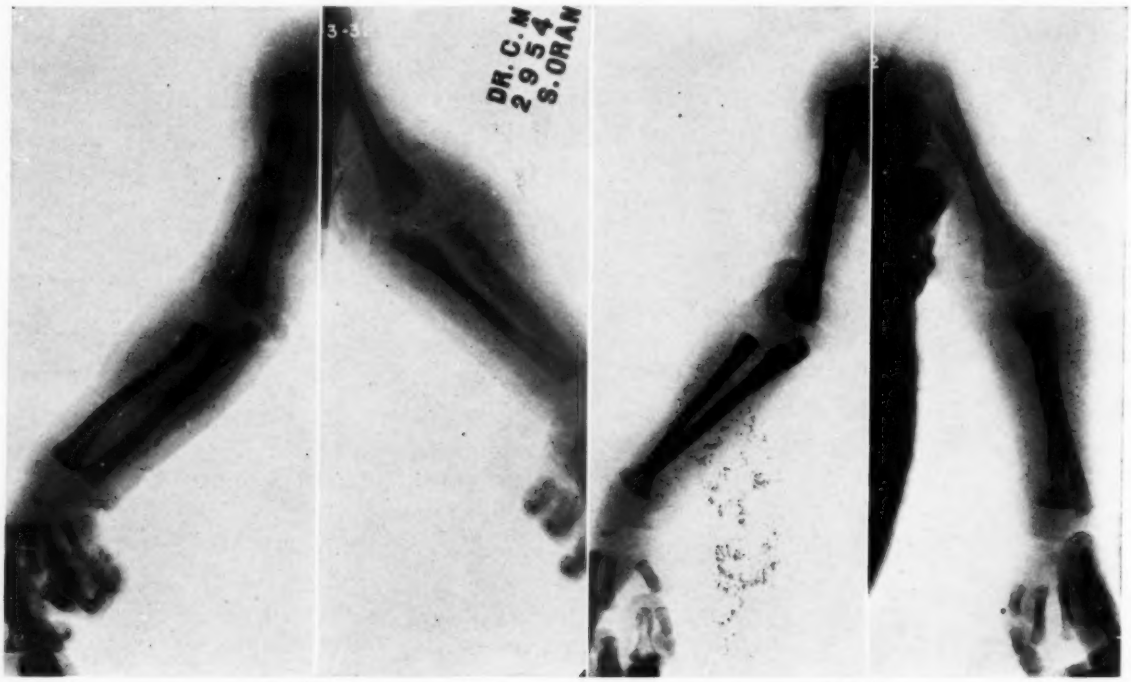
Course: September 15 the swelling had almost entirely disappeared. September 21 there was no swelling. September 28 the plaster was removed. There was a large scab on the posterior aspect of the thigh. October 25 the leg was perfectly straight; he still walked with a slight limp. November 1 there was no pain; he walked without a limp; no swelling or thickening was present. December 6, *x*-ray showed slight thickening of the periosteum, no sequestrum. March 20, 1934 there was no evidence of disease.

Case IV. R. L., male, aged four weeks. January 12, 1933.

There was a history of a difficult breach delivery. The left leg was said to have been injured at birth.

Examination: There was a large swelling over the upper end of the femur. *X*-ray showed the periosteum stripped from the femur around the great trochanter. There was a small area of degeneration in the great trochanter. The head of the femur was above the acetabulum. Temperature was 101°F.

Blood count: erythrocytes 5,000,000; leucocytes 12,000; polynuclears 68 per cent.



Left Right

Fig. 3. Case VI. *X*-ray showed extensive degenerative changes throughout entire radius.

A caliper splint was applied which immediately relieved pain.

Course: February 2 the swelling had almost entirely disappeared. April 1, *x*-ray showed the degenerative area at the upper end of the femur much reduced. *X*-ray June 24 showed the upper end of the femur very much reduced in size. The degenerative area had disappeared. September 26 *x*-ray showed the bone perfectly formed in the femur with the head in the acetabulum. June 5, 1934, no limitation of motion in the hip joint was noted. He walked very well. There has been no recurrence of the condition.

Case V. F. M., male, aged six weeks. January 13, 1933.

Birth was difficult. Two weeks after birth, he developed an abscess on the left side of the face which was opened and drained. Two weeks later he developed a large swelling in the upper thigh.

Examination showed marked thickening of the upper thigh, slight swelling over the great trochanter, and pain on pressure along the upper end of the femur. *X*-rays showed the

periosteum stripped from the upper third of the femur with a small area of degeneration of the great trochanter, and considerable new bone formation. Temperature was 101°F.

Blood count: erythrocytes 5,000,000; leucocytes 10,000; polynuclears 48 per cent.

A splint was applied.

Course: March 13, *x*-ray showed a very marked decrease in the size of the upper end of the femur. The degenerative area had disappeared. March 19, both hips were normal.

Case vi. B. H., female, aged five weeks. May 3, 1932.

When two and one-half weeks of age, this baby developed swelling on the left forearm, below the elbow. Later it extended down to the wrist. *X*-ray showed no evidence of disease.

Examination: There was marked thickening of the left forearm just below the elbow; sharp pain on motion of the arm, some heat and redness. An *x*-ray showed extensive degenerative changes throughout the entire left radius. Temperature was 100°F.

Blood count: erythrocytes 4,800,000; leucocytes 11,000; polynuclears 42 per cent.

A plaster dressing was applied.

Course: May 9, the swelling had very largely disappeared. May 16, no swelling was seen. July 29 *x*-ray showed almost complete regeneration of the radius with a small amount of degeneration at the upper end and a small sequestrum. The radius was about twice normal size. September 7 there was still a small sequestrum at the upper end of the radius. October 21 the plaster was removed. There was no swelling or thickening, but slight limitation of external rotation in the forearm. January 11, 1933 *x*-ray showed complete absence of sequestrum with considerable regeneration of the entire radius. July 29 the lower half of the radius was normal in size. July 13, 1934 there was still some thickening of the upper third of the radius; no pain; still some limitation of external rotation.

Case vii. M. L., male, aged thirty-eight. January 5, 1933.

The patient complained of pain in the left leg for the past two months, which had gradually become worse. He had lost considerable weight.

Examination: Some pain was noted on pressure over the upper end of the femur. *X*-ray showed no evidence of disease.

Blood count: erythrocytes 4,800,000; leucocytes 10,000; polynuclears 60 per cent.

Course: January 24 *x*-ray showed a degenerative area on the outer side of the femur just below the lesser trochanter. The periosteum was stripped from the femur for a distance of about 5 inches. An abscess was gradually developing. February 20 the abscess opened. About one quart of pus was discharged. The discharge gradually lessened. March 29 the abscess was closed. *X*-ray showed a slight degenerative area at the upper end of the femur; no evidence of a sequestrum. October 19, 1934, motion in the hip was perfect. There was no swelling and no evidence of osteomyelitis.

This patient was worried because of financial trouble, and consequently had been very upset for some time.

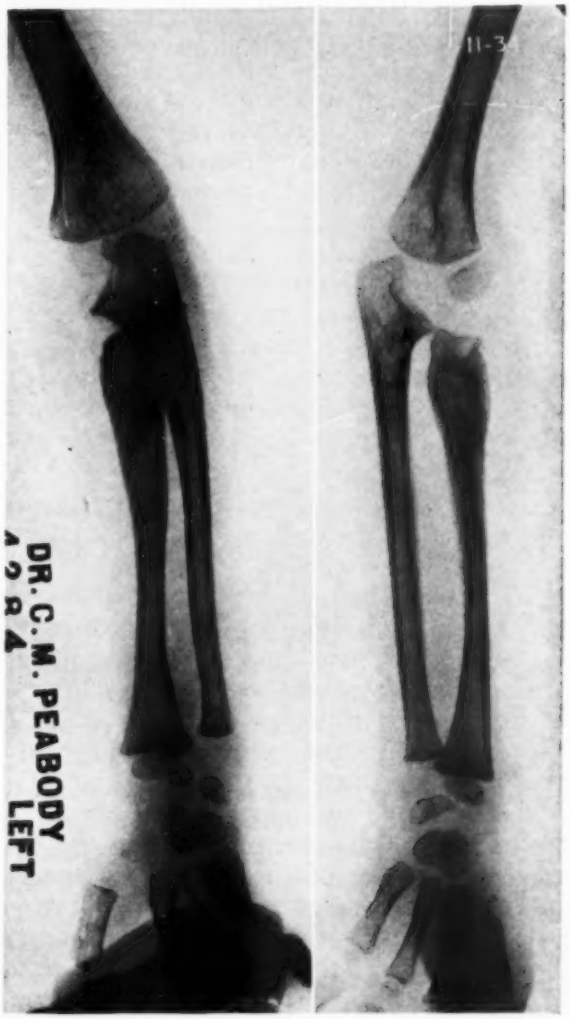


Fig. 4. Case vi. Final *x*-ray showed marked regeneration of radius. Lower two-thirds was normal.

Case VIII. E. F., female, aged twenty-six months. July 27, 1932. This child gave a history of having fallen downstairs December 28, 1931. Five weeks later the mother noticed swelling in the right ankle. Home remedies were administered.

Examination: *X*-ray showed a degenerative area at the lower end of the right tibia on the outer side with some sequestration. Temperature was 100°F.; blood count normal.

Plaster was applied.

Course: September 28 a small abscess developed over the external maleolus. January 18, 1933 the wound had healed. Since then there has been no further trouble. October 24 *x*-ray showed the lower end of the tibia quite irregular. The epiphysis was much narrower than normal. Apparently there was complete regeneration of the bone.

Case IX. S. C., female, aged thirty-five. August 22, 1933.

This patient broke her right leg when eight years of age. The leg became infected and she was treated at a hospital for four years. No further trouble was noted until the present illness. In July, eight days after the death of her mother, pain commenced in the right leg. The leg was still very painful and she was unable to straighten it.

Examination: Two long scars extended down the right leg from the upper end of the tibia to the ankle, one on the anterior surface, the other on the inner surface. The right leg was one inch shorter than the left. There was slight bowing of the lower third. The entire leg was swollen, red, and painful on pressure. The knee was held flexed at 145°. *X*-ray showed a degenerative area in the lower end of the tibia with some elevation of the periosteum. Temperature was 100°F.

Blood count: erythrocytes 4,800,000; leucocytes 12,000; polynuclears 47 per cent.

A plaster dressing was applied.

Course: August 29 the abscess opened spontaneously over the lower end of the tibia. October 3 the plaster was removed. There was no limitation of motion in the knee and no pain. Then abscess continued to discharge until October 4, 1934 when it closed. During all this time the patient was able to continue work.

Case X. L. R., male, aged eight months. February 7, 1933.

On February 5 the baby hurt his left leg which gradually became swollen and painful.

Examination: The left leg was very much swollen, indurated, with some redness. The knee was held flexed at 160°. Considerable heat was noted. Temperature was 102°F. *X*-rays were negative. The general condition was poor.

Blood count: erythrocytes 4,800,000; leucocytes 12,000; polynuclears 68 per cent.

A plaster dressing was applied.

Course: February 9 the child was comfortable with no pain. February 23 *x*-ray showed some periosteal thickening on the middle third of the fibula. March 9 the plaster was removed. The entire outer side of the leg was covered with scab. There was some discharge from a sinus over the fibula about 2 inches above the ankle joint; no pain. March 14 there was no discharge, no pain. The leg was still slightly thickened. July 1 the leg was apparently normal.

Case XI. M. P., female, aged twelve years. August 21, 1926.

She was in bathing at the shore seven days previous. Shortly after, she complained of pain in the right ankle.

Examination: The right ankle was very much swollen and enlarged. Considerable heat was noted. Pain was felt on pressure over the tibia and fibula. Some induration was present. Temperature was 102°F. *X*-ray showed an area of degeneration at the lower end of the right tibia, and slight periosteal elevation.

Blood count: erythrocytes 3,970,000; leucocytes 11,000; polynuclears 85 per cent.

A plaster dressing was applied.

Course: September 2 the plaster was removed. There was no swelling in the ankle and no pain. On November 13 no pain or swelling was found. January 1, 1927 *x*-ray showed slight degenerative changes. The ankle was cured.

Case XII. S. C., male, aged fifteen. February 5, 1927.

This boy had had a discharging sinus on the right thigh, and another discharging sinus over the right leg which was now healed.

Examination: A large scar over the outer side of the right femur extended from the middle third of the thigh downward. A discharging sinus was present at the lower end. There was also a scar over the right tibia over the site of the previous sinus. *X*-ray showed a small sequestrum.

Blood count: erythrocytes 5,400,000; leucocytes 12,000; polynuclears 78 per cent.

A plaster dressing was applied.

Course: May 27 he was admitted to the

hospital. The sequestrum was removed, the cavity packed with vaseline gauze. Healing progressed favorably. December 18 the temperature rose to 102°F. The left leg became swollen. December 20 abcess opened on left leg. May 15, 1928 the abscess was closed. The cast was removed. The right leg continued to discharge. July 15, 1929 the abscess on the right thigh had healed. He remained well until November 1934 when he lost his job. November 10 the abscess on the right femur broke down again. He had no further trouble with the left leg.

Case XIII. I. S., male, aged fourteen years. April 29, 1930.

The patient gave a history of having been hit by a baseball on April 14. On the 15 he had pain in the knee and some pain in the groin.

Examination showed slight swelling in the right knee; pain on pressure over the thigh above the knee, some thickening of the lower thigh. *X*-ray was negative. Temperature was 100°F.

Blood count: erythrocytes 4,800,000; leucocytes 12,000; polynuclears 76 per cent.

A plaster dressing was applied from ankle to groin.

Course: May 20 the entire lower end of the femur was thickened. *X*-ray showed extensive degeneration in the lower half of the femur. May 23 a plaster spica was applied. The swelling gradually lessened. Frequent *x*-rays showed regeneration of the bone. On October 4 the spica was removed and a caliper splint applied. *X*-rays at this time showed some sequestration. November 6 a red, indurated area appeared on the posterior aspect of the leg just above the knee joint. November 26 the abscess opened. This abscess has continued discharging ever since. *X*-ray shows no evidence of sequestrum.

Two errors were made in the treatment of this patient. First, he should have had a spica applied in the beginning, as the short plaster did not relieve the pain. Second, he was discharged from the hospital too soon.

Case XIV. A. B., female, aged nine years. June 27, 1930.

This girl gave history of having had inflammatory rheumatism beginning February 8, 1930. The leg was now deformed and she could not walk.

Examination: The right hip was held flexed at 160°, 20 per cent adducted. The head of the femur was much higher than normal. There was some pain on extremes of motion. The general condition was fair, no temperature, blood count normal. *X*-ray showed extensive degenerative changes in the upper third of the right femur. The hip was dislocated, the epiphysis not destroyed. She was admitted to the hospital and the deformity corrected by manipulation. It was impossible to reduce the dislocation.

Course: September 8 she was discharged from the hospital walking. December 11, there had been no evidence of recurrence of the osteomyelitis. Jan. 3, 1931 her condition was excellent, with no evidence of return of the disease.

Case XV. R. P., male, aged five years. August 14, 1930.

Six weeks ago he had chills and fever followed by pain in the knees and hip. There was a discharging sore on the left foot.

Examination: The general condition was poor. The right hip was held at 170° flexion, in slight adduction. All motion was limited by pain. There was some thickening about the hip and a small discharging sore on the left instep. *X*-ray showed marked degenerative changes of the upper third of the right femur and also of the fourth and fifth metatarsals of the left foot. No sequestrum was noted. There was no fever.

Blood count: erythrocytes 3,400,000; leucocytes 10,000; polynuclears 46 per cent.

A spica was applied to the right hip.

Course: October 22 the spica was removed from the hip. Pain and spasm had disappeared; swelling was much less. January 15 1931 there was no discharge from the foot. July 15 *x*-ray showed marked regeneration of the femur, no sequestrum. In September there was no evidence of return of the disease.

Case XVI. E. McD., male, aged fourteen years. July 26, 1923.

The patient had been admitted to Knickerbocker Hospital in April 23. He complained of pain in the right thigh. Temperature was 105°F. Some swelling was present in the right hip. There was marked spasm of the muscles and some pain in the wrists.

Blood count (April 27): Erythrocytes 4,690,000; leucocytes 15,200.

Blood culture showed staphylococci.

April 29 the glands of the neck became swollen. May 1 the index finger of the right hand was very much swollen. Operation was performed, staphylococci were cultured. May 7

the finger had healed. May 30 there was a slight discharge from the right hip. *X*-ray showed absorption of the head of the right femur, the head displaced upward, and some necrosis of the acetabulum.

July 26 the boy came under my care. *X*-rays were taken which showed destruction of the right hip joint, fusion of bone, some degeneration at the upper end of the right humerus, marked thickening of the left clavicle, and some destruction in the lower half of the right ulna. The entire first metacarpal of the right hand and the second metacarpal of the left hand were very much thickened. The first phalanx of the index finger showed considerable thickening. There was also a degenerative area at the upper end of the left humerus. All these foci of infection were drained from time to time, as they flared up. He was operated on once in 1923, three times in 1924, and once in 1925.

December 23, 1925 he was very anxious to go home for Christmas, but as there was still slight discharge from the hip, he was advised to remain until this cleared up. December 24 he became very much upset. December 25 the left elbow was very much swollen. December 26 an abscess over the left clavicle opened. The left elbow opened and the wound on the hip discharged very freely.

January 17, 1926 he was discharged from the hospital. All sinuses were closed. On January 19 he returned to the clinic with three discharging sinuses, one on the hand, one on the shoulder, and one over the tibia. March 11 the abscesses had entirely healed again. There was no further trouble until January 29, 1927 when he was in an auto accident. An abscess developed under the left arm. This promptly healed.

November 13, 1930 another abscess formed on the right hip and discharged for a few days. He had no further abscesses.

September 12, 1932 he died of nephritis.

This case was reported because the patient so beautifully demonstrated the effect of temper on osteomyelitis. On December 24th he became very much upset. On December 26th, three sinuses were discharging very freely. January 17th all sinuses had been closed and he was discharged cured. On the 19th, after being upset again at home, he came back with three discharging sinuses.

Case xvii. F. H., female, aged five years. December 10, 1929.

The child complained of pain in the right leg. She fell off a swing in May. At times she had pain in the thigh.

Examination showed slight limitation of motion with pain in the right hip, some atrophy of the right thigh and calf, no fever. Blood count was normal. *X*-ray showed a small area of degeneration near the lesser trochanter.

A plaster dressing was applied.

Course: December 21 *x*-ray showed no change in the child's condition. February 4, 1930 the plaster was removed. *X*-ray showed a slight degenerative area. There was no pain. June 2 there was still a slight degenerative area. September 20 there was no pain or swelling, no sign of disease.

Case xviii. R. C., male, aged fifteen years. May 22, 1930.

He gave a history of having hurt the right leg six months previous, while playing football. The leg had become swollen and painful. It was opened and had discharged ever since.

Examination: There was considerable atrophy of the left leg, a large area of scar. Three open discharging sinuses were present. At the lower opening a sequestrum was visible. *X*-ray showed degenerative changes throughout the entire tibia with a large sequestrum lying over the anterior surface.

The sequestrum was removed, the wound packed with vaseline gauze and a plaster dressing applied.

Course: June 7 the cast was removed. June 25 the patient became very much upset. June 27 the right elbow became swollen and painful. On July 14 the elbow opened. The wounds on the elbow and leg continued to discharge. October 4 he complained of pain in the back. No pathological condition was found. October 9 *X*-ray showed partial destruction of the eighth and ninth dorsal vertebrae. November 10 the pain in the back disappeared. December 15 the abscess in the elbow closed. December 21 the abscess in the leg closed. Since that time he has had no further return of disease.

This patient also illustrates the effect of temper. On June 25th he had some trouble and became very much upset. On the 27th, the right elbow was swollen.

Case xix. A. A., female, aged twelve. January 26, 1928.

She gave a history of having had pain in the right wrist in March 1927. She went to a

hospital and was operated on five times. She still has a discharging sinus.

Examination: Several scars extended from the middle of the humerus downward to the wrist. The elbow was stiff at 135°. Two discharging sinuses were present over the right radius. *X*-ray showed extensive degenerative changes throughout the right radius.

Course: February 10 the wound was still discharging and the wounds continued to discharge until May 3, 1928 when they were closed. No further trouble occurred until January 5, 1929 when a small abscess developed. January 26 the wound closed. April 4 a small abscess developed, which healed on May 21. June 24, 1931 another abscess formed which closed on June 30. No further disease has manifested itself.

This patient, presenting a case of chronic osteomyelitis, has had a great many exacerbations, which have promptly healed without any treatment except intestinal.

Case xx. C. J., female, aged ten years. March 30, 1926.

She gave a history of having had grippe four weeks previously, followed by pain in the knee and swelling of the leg.

Examination: The lower half of the right thigh was very much swollen, indurated, and all motion in the knee was limited by pain. Pain was felt on pressure over the lower half of the femur. Temperature was 101°F. *X*-ray showed extensive periosteal stripping over the lower two-thirds of the femur; some degenerative changes in the bone.

Blood count: erythrocytes 5,000,000; leucocytes 14,000; polynuclears 70 per cent.

A plaster dressing was applied.

Course: April 23 *x*-ray showed a small area of degeneration over the middle third of the femur. The swelling was very much less. May 10 some regeneration was noted, this child did not develop an abscess until November 21. It continued to discharge until March 3, 1927 when the abscess was healed. *X*-ray showed very marked regeneration of the entire femur, no sequestrum. The patient has had no further sign of disease. In January 1928 the patient reported there had been no further discharge.

CONCLUSIONS

1. Operation is not only useless, it is positively harmful.
2. Osteomyelitis is due to intestinal poisoning which lowers the germicidal qualities of the blood.
3. Osteomyelitis is a blood-borne disease starting beneath the periosteum.
4. The sequestrum will be carried off by the blood stream if left alone.
5. Pain can be relieved by proper splinting.
6. Anything which upsets the patient will prolong the disease.
7. Twenty cases are reported.

REFERENCES OF DR. LICHTENSTEIN*

9. Lee, H., and Staley, R. W. Inflammatory strictures of the rectum and their relation to lymphogranuloma inguinale. *Ann. Surg.*, 100: 486 (Sept.) 1934.
10. Stannus, H. S. A Sixth Venereal Disease. Balt., Wood, 1933. *Trop. Diseases Bull.*, 31: 437, 1934. [Extensive bibliography.]
11. Lichtenstein, L., and von Haam, E. The usefulness of organ emulsions of infected animals in the diagnosis of lymphogranuloma inguinale. *Proc. Soc. Exp. Biol. & Med.*, 32: 952, 1935.
12. Hellerström, S., and Wassén, E. *Verh. 8th. Intern. Kongr. Dermat. u. Syph.*, Kopenhagen (Aug. 5) 1930. Copenhagen, Engelsen and Schroeder, 1931, p. 1147.
13. Levaditi, C., Ravaut, P., Lepine, P., and Schoen, R. Étude etiologique et pathogenique de la maladie de Nicolas et Favre. *Ann. Inst. Pasteur*, 48: 27–88, 1932.
14. Nicholas, J., Lebeuf, F., and Charpy, J. Quoted by Stannus.
15. Hillsman, J. A., Wilshusen, H. F., and Zimmerman, H. M. Lymphogranulomatosis inguinalis. Autopsy report. *Arch. Dermat. & Syph.*, 18: 383, 1928.
16. Ravaut, Levaditi, Lambling and Cachera. Quoted by Stannus.
17. Barthels, C., and Biberstein, H. Zur Ätologie der Entzündlichen Rektumstrikturen. *Beitr. z. klin. Chir.*, 152: 161, 1931. Elephantiasis penis et scroti in lymphogranuloma inguinale. *Ibid.*, p. 325. Zur Histogenese der nach L. I. Auftretenden Rektumstrikturen. *Ibid.*, p. 464.
18. Witherspoon, J. T. The syphilitic origin of elephantiasis of the vulva. *Am. J. Syph.*, 17: 499 (Oct.) 1933.
19. Ravaut, P., Seneque, J., and Cachera, R. Quoted by Stannus.
20. Kaufmann, E. Textbook of Pathological Anatomy. Eng. trans. by S. P. Reimann. Phila., Blakiston, 1929, 2: 842.

*Continued from p. 126.

EPHEDRINE SULPHATE IN SPINAL ANESTHESIA

ADMINISTERED PRIOR TO SUBDURAL BLOCK*

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THE study of the safety of spinal anesthesia must extend beyond a consideration of the anesthesia-producing drugs per se or the methods of inducing spinal anesthesia. With very few exceptions, most spinal anesthetic agents in general use today are relatively safe, and one uses that particular preparation to which he is most accustomed. In addition, changes in position on the table, and admixtures of the drug with substances of different specific gravity, have also failed to alter the uncontrollability of spinal anesthesia. The studies of Co Tui[6] and Vehrs[23] on the hydrodynamics of the subdural space do not coincide with clinical findings, and disregard the great affinity of novocaine solution for nerve tissues. Therefore, for the present at least, attention must be focused upon those methods and drugs that will help to lessen and regulate the intensity of the spinal "shock" produced with spinal anesthesia. Great falls in blood pressure should not be considered too lightly, and methods to minimize such depressions should be utilized. Since observing the course of spinal anesthesia among several thousands of patients upon whom we have operated and have induced the anesthesia ourselves, we can not agree with the views of the late Gaston Labat and others that "a drop of blood pressure is no longer considered a dangerous feature, since it expresses only the dilatation of the splanchnic blood vessels in terms of the peripheral arterial contraction."[1,27]

The cause for the fall in blood pressure has been inadequately explained by the shift in blood volume from the periphery of the body to the splanchnic region. We ourselves have repeatedly failed to notice extreme vasodilatation in the splanchnic region in the course of abdominal operations. Paralysis of the splanchnics alone, with the resultant pooling of blood in the abdominal viscera, appears to be only one of the factors concerned with the blood-pressure alteration.[2] The typical blood-pressure fall of spinal anesthesia can be produced in animals with both splanchnics completely severed. Section of both splanchnic nerves above the diaphragm results in only an 11 per cent drop in the general blood pressure. Apparently the entire vasomotor system participates in the vasodilatation and the degree of blood pressure depression is in direct ratio to the number of white rami anesthetized. Bower[7] in 1926 observed that root block of the splanchnic area, such as occurs in spinal anesthesia, if confined entirely to the splanchnic area causes but a slight fall in blood pressure.

Grodinsky and Baker[3] concluded from a series of experiments that myocardial weakness resulting from interference with respiration was not involved in the mechanism of blood-pressure fall. Respiratory embarrassment does occur, but only in a concomitant relation to blood-pressure fall rather than in one of cause and effect. With complete cessation of respiration, there is an additional sharp drop in blood pressure (after a preliminary anoxemic

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rise) due to cardiac failure, but this is a terminal phenomenon and not the ordinary fall compatible with safe anesthesia. They

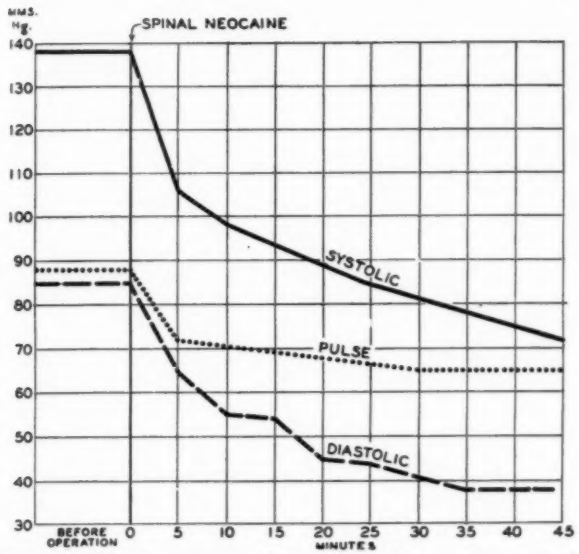

Fig. 1. Blood pressure chart of patient under spinal anesthesia without preliminary ephedrine sulphate. A sudden marked fall in systolic and diastolic pressures; no indication of returning to normal pressure after fifty minutes. Operation: myomectomy and Watkin's interposition operation. No. 15130.

contend that it is still possible after spinal anesthesia to produce vasoconstriction and rise in blood pressure by stimulation of the post-ganglionic fibers or myoneural junctions as with the use of ephedrine.

According to Sise,[10] it is probable that anoxemia plays a very important part in the production of blood-pressure fall. If anoxemia is prevented by properly applied artificial respiration, animals can be kept alive for hours without marked falls in blood pressure. Clinically, we have observed patients with almost complete cessation of respiratory movements, revived by artificial respiration and inhalations of oxygen, or oxygen combined with carbon dioxide. In all such instances of impending disaster, the blood pressures were very low, or unobtainable.

Seevers and Waters[5] call attention to the fact that skeletal muscle tone is essential for the maintenance of a stable capillary and venous bed. Loss of this tone accompanies any intradural block. Undoubtedly the splanchnic area is not the only region in which one can expect an enlarged capillary bed. Plethysmographic records made in their laboratory indicate a considerable increase in leg volume of dogs under spinal

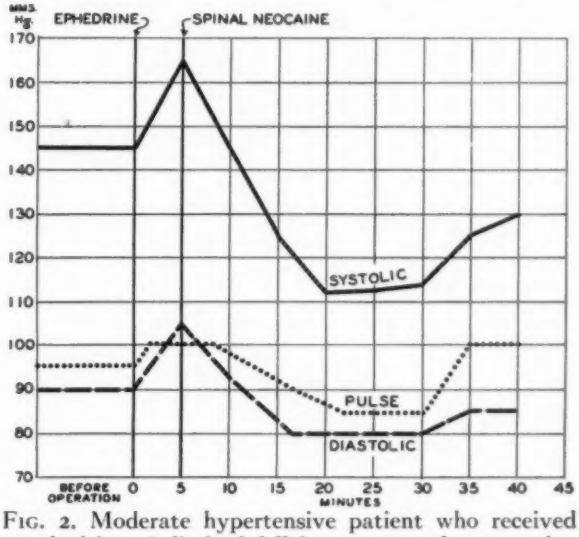

Fig. 2. Moderate hypertensive patient who received ephedrine. A limited fall in pressure after neocaine injection, with rising pressures after thirty minutes. Contrast with Figure 1. Operation: appendicectomy. No. 13526.

anesthesia. The increased vascular bed means low blood pressure, diminished minute volume flow of blood, and poor oxygenation of tissues. The integrity of the medullary centers and heart is dependent upon an adequate supply of oxygen. The additional anoxemia accompanying partial or complete thoracic paralysis may spell disaster. They contend that the oxygen needs of the body are not adequately met, owing to a reduced volume flow of blood and a decreased gaseous exchange in the lungs proportional to the thoracic excursion. Ephedrine, on the other hand, increases the minute volume output of the heart by direct action on the cardiac muscle.

The pronounced instability of the vasomotor system as additional cause for blood-pressure falls during spinal anesthesia has been shown by Thompson.[4] Postural changes in anesthetized dogs such as removal of a dog from the Trendelenburg position to the horizontal position caused a great drop in blood pressure and a cessation of respiration. He also found that no paralysis of respiration occurred after the lumbar injection, when vascular tone

was maintained by a preliminary injection of ephedrine. He concluded that the function of the respiratory center fails if the

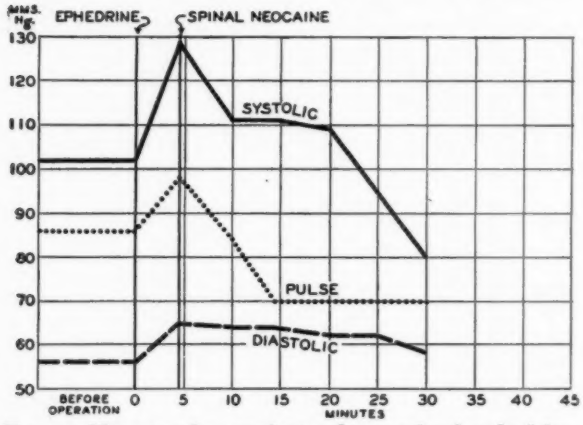

Fig. 3. Hypotensive patient who received ephedrine. A marked fall in pressure, continuing downward after thirty minutes. Hypotensive patients are ephedrine-resistant. Operation: myomectomy, oophorectomy and appendicectomy. No. 15870.

circulation falls below a certain level of efficiency. The collapse of circulation and the resultant bulbar anemia appear to be intimately associated with respiratory failure. Paralysis of respiration during spinal anesthesia did not occur when a fall in blood pressure did not take place, or was prevented by a preliminary administration of ephedrine.

Co Tui[6] has shown that in the state of low blood pressure induced by spinal anesthesia, even though the arterial oxygen content may be slightly raised by artificial respiration, there is a lower oxygen content of the venous blood. Oxygen is not delivered in sufficient amount to the tissues and there is tissue asphyxia. He studied the effect of ephedrine in this form of shock, and concluded that ephedrine because of its sympatheticomimetic action is a substitute for the lost nervous regulation, and therefore effective.

Ockerblad and Dillon[16] in 1926 were among the first to precede the induction of spinal anesthesia with an injection of ephedrine sulphate. They concluded that the judicious use of ephedrine successfully restores the right amount of arterial tension to offset the dangerous drop in both systolic and diastolic blood pressure. Newton[8] used ephedrine in 16 consecutive patients for thoracoplastic operations. Those patients who received ephedrine had less of a fall in blood pressure than those who

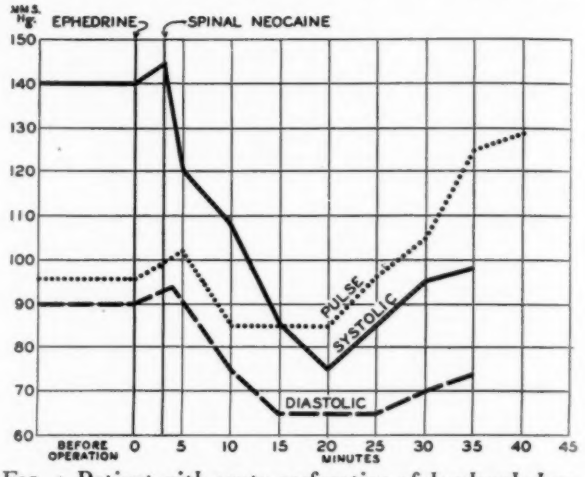

Fig. 4. Patient with acute perforation of duodenal ulcer, moderate shock. Neocaine spinal anesthesia preceded by ephedrine. Pressures begin to rise in twenty minutes due to ephedrine, even in such grave conditions. No. 13990.

did not receive the drug. Essex and Lundy[9] used ephedrine in more than 6000 cases and noted a lessened fall in blood pressure. Woodbridge[11] also states that ephedrine greatly lessens the fall of blood pressure, and Lundy[12] makes identical observations. Wehrbeim[14] reports lessened drops in blood pressure when administering ephedrine five minutes before spinal injection in 300 cases, and Holder[15] reports excellent results in 151 cases when ephedrine was injected fifteen minutes prior to the spinal anesthesia. The latter omitted ephedrine in a like series of cases and found that those patients who received ephedrine recorded an average blood-pressure fall of 12.8 mm. Hg while those who failed to receive ephedrine showed an average blood-pressure drop of 37.5 mm. Hg.

PHARMACOLOGY OF EPHEDRINE IN ITS RELATIONSHIP TO SPINAL ANESTHESIA

1. *Action of Ephedrine upon the Heart.* Burch and Harrison[17] inserted carotid cannulas connected to manometers in dogs under the influence of barbital anesthesia. The cardiac output was usually much increased after ephedrine, and the degree of increase was usually greater than that found in normal dogs. The rises in cardiac

output and blood pressure were sustained for thirty minutes or longer in most of the experiments. When a dose of ephedrine was given to a dog later anesthetized by a spinal anesthetic, no decline in blood pressure occurred even though successive large doses of the spinal anesthetic were given. Also, ephedrine markedly decreases the susceptibility to hemorrhage of dogs under spinal anesthesia.

Investigating the action of ephedrine in coronary flow, Stoland and Ginsberg[18] found that ephedrine augments coronary flow in the mammalian heart and heart-lung preparations. Their experiments were performed on 13 dogs and in every case the injection of a suitable dose of ephedrine produced a fairly marked and sustained increase of flow through the coronary system. The maximum coronary flow occurred from two to eighteen minutes after the injection. The amount of increase varied from 40 to 400 per cent, although the average increase was about 100 per cent. Quite important was their observation that the increased coronary flow was maintained much longer than the rise in blood pressure. This would indicate that the principal increase in coronary flow following ephedrine injection is caused by a dilatation of the arteries or capillaries or both from a sympatheticomimetic action. Repeated injections of ephedrine within a period of one hour are contraindicated because of their tendency to decrease the coronary flow. Results show that the return of blood pressure to normal after the administration of ephedrine is no indication that the animal has recovered from the ephedrine effect. Therefore, (1) the increase of coronary flow is not due to increased blood pressure and (2) repeated injections of ephedrine cause a diminishing effect upon blood pressure and coronary flow. Leyko,[24] using Starling's heart-lung preparation, found that ephedrine (1 c.c. 1:5000) like adrenalin (1 c.c. 1:100,000) increased the coronary flow 46 per cent. He stated that the increase in coronary flow was more sustained following ephedrine than it was during adrenalin administration.

Chen and Schmidt[26] found that ephedrine increased the outflow from the coronary vessels of the rabbit's heart perfused by the Langendorff method. The cardiac stimulant effect of small quantities of ephedrine is well marked in the case of the human heart. Its effect is not only upon the extreme peripheral parts of the accelerator system, but upon its ganglia as well.

2. *Action of Ephedrine upon the Blood Vessels.* Ephedrine causes vasoconstriction, a peripheral action not dependent upon stimulation of the vasomotor center or other parts of the central nervous system. The same conclusions were reached by Marcu and Gheorghiu,[19] and by Heymans.[25] They found ephedrine effective in raising the blood pressure of animals whose central nervous systems were destroyed or paralyzed. By crossed-circulation experiments, it was found that ephedrine still raised blood pressure after exclusion of cardiac and splanchnic effects.

3. *Action of Ephedrine on Respiration.* Ephedrine is a stimulant to the respiratory center, resembling caffeine in its effects. Schmidt[26] found that ephedrine was more regularly effective than any of the conventional respiratory stimulants in combating extreme respiratory depression due to morphine. The action of ephedrine upon the respiratory center seems to consist of two distinct components: (1) an increase in blood supply of the center, due to the pressor effect; (2) a direct stimulant action upon the cells of the center. Ephedrine seems to be the most useful single respiratory stimulant drug that is available at present.

CLINICAL OBSERVATIONS WITH PRE-ANESTHETIC EPHEDRINE

The present study, consisting of 108 cases of spinal anesthesia preceded by ephedrine sulphate injections, was made upon patients undergoing all types of subdiaphragmatic operations. This operative work included subtotal gastrectomies, cholecystectomies, appendicectomies, intestinal resections, pelvic visceral operations and rectal operations. Neocaine was

the routine anesthetic used, our attitude being that we understand this drug better than any other spinal anesthetic. The average dose was 120 mg., rarely 150 mg. Subdural block anesthesia was initiated usually through the second lumbar space.

At first the action of ephedrine was studied upon 5 supposedly normal persons who presented no apparent cardiovascular pathology. Fifty milligrams of ephedrine sulphate were injected subcutaneously while at rest, and blood-pressure readings tabulated every two to three minutes. All subjects presented blood pressures within normal limits prior to the ephedrine injections, except one individual whom we considered a hypotensive, with readings of 102 mm. Hg systolic and 60 mm. Hg diastolic. The increases in blood pressure after ephedrine were:

Subject	Systolic	Diastolic	
1.....	18 mm.	10 mm.	
2.....	18 mm.	4 mm.	
3.....	10 mm.	8 mm.	
4.....	30 mm.	10 mm.	
5.....	6 mm.	2 mm.	(hypotensive)

The maximum rise in blood pressure occurred between fifteen and twenty-five minutes following the injection of ephedrine and it then gradually receded. The blood-pressure rise effected by the ephedrine persisted for at least four hours, at which time, excluding the hypotensive individual, there remained a systolic elevation of 6 to 10 mm. Hg over the initial pressure. All remained fully alert, holding conversations occasionally; two complained of fullness in the head. Palpitation occurred in all of the cases and the pulse palpated at the radial artery remained unchanged in rate, but more forceful. Slight elevations in pressure were noted after emotional stimuli, physical movements, efforts at reading, etc.

The lack of pronounced ephedrine effects upon the hypotensive individual coincided with the findings of Chen and others, in that ephedrine in chronic or subacute hypotensives has with some exceptions not proved as promising as had been hoped for. These people are termed ephedrine-resistant. In fact, North[22] suggests a test dose of ephedrine in hypotensives before submitting them to spinal anesthesia in order to ascertain whether by this means they can be fortified against a great fall in pressure. These observations also coincide with those of Leveuf[20] and Foged,[21] in their experiments on ephedrine in normal individuals. Their spinal anesthesia experiments also included the effects of ephedrine when administered orally and intravenously prior to the induction of spinal anesthesia.

As is well known, the maximum fall in blood pressure during spinal anesthesia occurs in about twenty to twenty-five minutes after the injection of the anesthetic. The ephedrine sulphate (50 mg.) was injected one minute to one and a half hours prior to the induction of spinal anesthesia, in an effort to ascertain the optimum pre-anesthetic time of injection of the pressor drug. Much to our surprise we learned that it mattered little at what stage the ephedrine was injected up to the first forty-five minutes preceding spinal anesthesia injection. The action of ephedrine w as manifested during this whole period by diminution of the blood-pressure fall, active peripheral bleeding, etc. The best results of preliminary ephedrine injections were noted in patients termed normal tensives and moderate hypertensives. Those in the hypotensive class demonstrated their resistance to the drug as was observed in our study upon normal individuals.

Throughout the operation the effects of ephedrine previously administered were very evident. Only 17 per cent of our patients were troubled with nausea; and vomiting occasionally occurred in abdominal operations, especially where traction was made upon upper abdominal viscera and other structures. When a preliminary sedative, such as sodium amytal was given, gastric upsets were noted most frequently. Ephedrine patients presented a better color of the skin and mucous membranes; great pallor and cyanosis

were lacking. Subjectively, these patients were more alert, more cooperative and less drowsy, with no feeling of impending disaster. They carried on intelligent conversations with the anesthetist. The pulse was more forceful with almost no noticeable changes in rate when contrasted with patients who received no preliminary ephedrine. Respiratory movements were neither shallow nor slow with no feeling of chest tightening and inability to draw a deep breath. Of course, there was no peripheral ischemia as when ephedrine was omitted, and these patients bled quite profusely, demonstrating the pressor effect of the drug. Many hemostats were required to control bleeding in the subcutaneous structures. Postoperative retention of urine was less troublesome, about 70 per cent of the patients voiding within ten to twleve hours after having been returned to bed.

CONCLUSION

1. Traditional views relative to the harmlessness of great depressions of blood pressure during spinal anesthesia must be discarded, and efforts initiated to curtail or diminish falls in pressure.

2. Ephedrine sulphate administered prior to the spinal anesthesia causes vasoconstriction, increases the coronary flow, stimulates the myocardium and the respiratory system, thus minimizing spinal "shock" and blood-pressure fall.

3. Normal tensives and moderate hypertensives react best to the pressor influence of ephedrine during spinal anesthesia.

4. So-called hypotensive patients are usually ephedrine-resistant and should receive a preliminary test dose of ephedrine to learn whether even with the aid of the pressor drug they may safely be carried through spinal anesthesia.

REFERENCES

1. Labat, G. The trend of subarachnoid block. *S. Clin. N. Amer.*, 10: (June) 1930.
2. Ferguson, L. K., and North, J. P. Observations on experimental spinal anesthesia. *Surg. Gynec. Obst.*, 54: 634 (April) 1932.
3. Grodinsky, M., and Baker, C. Spinal anesthesia. *Surg. Gynec. Obst.*, 57: 197–200 (Aug.) 1933.
4. Thompson, K. W. Spinal anesthesia—an experimental study. *Surg. Gynec. Obst.*, 58: 852–865 (May) 1934.
5. Seevers, M. H., and Waters, R. M. Respiratory and circulatory changes during spinal anesthesia. *J. A. M. A.*, 99: 961–968 (Sept. 17) 1932.
6. Co Tui, F. W. Further studies in subarachnoid anesthesia. *Anesth. & Analg.*, 13: 143; 183 (July-Oct.) 1934.
7. Bower, J. O., Wagoner, G., and Clear, J. H. Spinal anesthesia. *Anesth. & Analg.*, 5: 95–101, 1926.
8. Newton, H. F. Spinal anesthesia in thoracoplastic operations for pulmonary tuberculosis. *J. Thoracic Surg.*, 4: 414–427 (April) 1935.
9. Essex, H. E., and Lundy, J. S. Laboratory and clinical observations. *S. Clin. N. Amer.*, 12: 1053–1058 (April) 1932.
10. Sise, L. Control of blood pressure in spinal anesthesia. *S. Clin. N. Amer.*, 12: 643–648 (June) 1932.
11. Woodbridge, P. Sodium amytal and ephedrine. *S. Clin. N. Amer.*, 11: 351 (April) 1931.
12. Lundy, J. S. Suggestions on use of ephedrine in spinal anesthesia. *S. Clin. N. Amer.*, 13: no. 4 (Aug.) 1933.
13. McKittrick, L. S., McClure, W., and Sweet, R. S. Spinal anesthesia in abdominal surgery. *Surg. Gynec. Obst.*, 52: 898–909 (April) 1931.
14. Wehrbein, H. L. Ephedrine in spinal anesthesia. *Brit. J. Anaes.*, 5: 178 (April) 1928.
15. Holder, H. G. Use of ephedrine. *California & West. Med.*, 29: 246, 1928.
16. Ockerblad, N. F., and Dillon, T. G. Use of ephedrine in spinal anesthesia. *J. Urol.*, 21: 77–82 (Jan.) 1929.
17. Burch, J. C., and Harrison, R. Effect of ephedrine on circulation of dogs during spinal anesthesia. *Surg. Gynec. Obst.*, 52: 953–954 (May) 1931.
18. Stoland, O. O., and Ginsberg, A. M. Effect of ephedrine on coronary circulation. *J. Pharmacol. & Exper. Therap.*, 49: 345–351 (Nov.) 1933.
19. Marcu, I., and Gheorghiu, P. The vasoconstriction action of ephedrine. *Compt. rend. Soc. de Biol.*, 96: 1447, 1927.
20. Leveuf, J. Treatment of hypotension in spinal anesthesia. *Bull. et. mém. Soc. Nat. de chir.*, 58: 82–87 (Jan. 23) 1932.
21. Foged, J. The action of ephedrine and ephetonin on the blood pressure. *Arch. f. Exper. Path. u Pharm.*, 159: 328–337 (Feb. 23) 1931.
22. North, J. P. Use and abuse of spinal anesthesia. *Ann. Surg.*, 101: 702–707 (Feb.) 1935.
23. Vehrs, G. Spinal Anesthesia. St. Louis, Mosby, 1934.
24. Leyko. *J. Pharmacol. & Exper. Therap.*, 38: 31, 1930.
25. Heymans, C. *Arch. Internat. Pharm. Ther.*, 35: 307, 1929.
26. Chen, K. K., and Schmidt, C. F. The action and clinical use of ephedrine, and alkaloid isolated from the Chinese drug, ma huang. *J. A. M. A.*, 87: 836, 1926.
27. Koster, H., and Kasman, L. Spinal anesthesia for head, neck, thorax. *Surg. Gynec. Obst.*, 49: 617–630 (Nov.) 1929.

CASE REPORTS

BONE GRAFTS IN THE TREATMENT OF NON-UNION

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As early as 1842, Norris, in an article on "Non-Union After Fracture," classified the causes of non-union as constitutional and local. There has been nothing to add to this classification to the present day.

It is my purpose in this paper to consider only the local causes of non-union, giving what I deem the causes, based on my own experience, and the treatment which has been most satisfactory in my hands. I will discuss only non-union of the long bones, cases of the neck of the femur and carpal bones being excluded.

In considering the repair of fractures, whether we support the cellular or the physiochemical theory, we all agree that as soon as a break occurs in the continuity of a bone, an extravasation of blood follows which very quickly becomes coagulated, this coagulation being the primary basis of repair. It soon gives up its hematopoietic elements and is rapidly invaded by fibroblasts which aid in the organization of the clot and the transformation into embryonic connective tissue.

Leriche and Policard, studying fractures during the War, were able to find bone granules in this reorganizing tissue as early as the sixth day after fracture. It is my opinion that the inception of non-union in a large percentage of local fractures occurs in this early period.

In a discussion of non-union one must, of course, rule out delayed union and consider only those cases in which there is no evidence of active repair either clinically or by *x*-ray examination. There is no arbitrary period of time after which one can state that a definite non-union exists. However, most writers feel that if no union has occurred after six months definite non-union is established. In the diagnosis of non-union, I believe it wise to consider the history very carefully, and after excluding constitutional causes, look carefully into the treatment that has been used. It is my belief that delayed union, rather than non-union, can be traced to constitutional causes, and I am accordingly not considering general conditions except to eliminate them in the diagnosis.

The etiology of non-union has been divided under four headings:

1. Improper reduction with wide separation of fragments.
2. Inadequate fixation.
3. Interference with circulation.
4. Interposition of soft tissue.

In considering *improper reduction with wide separation of fragments* we must naturally consider separation due to overtraction. This, I believe, has increased tremendously in importance during the past few years with the increased use of skeletal traction in the hands of the more or less inexperienced. It is my firm belief that there is no single cause of non-union today to which more cases can be traced. I include 2 such cases here.

Inadequate fixation is undoubtedly occasionally responsible for non-union. How-

ever, if there is approximation of the fragments, I believe there is always some attempt at repair.

Fig. 1. Case I.

Interference with circulation is generally construed to mean a failure of the nutrient arteries to function, but I believe nutrition from the outside through muscular attachments to be of greater importance since we see our largest percentage of non-union cases where muscular attachments are scant, as in the lower third of the tibia;[1] the high frequency of non-union in the fractures of the neck of the femur, as well as in the carpal bones, tends to bear out this point. It is further proved by the fact that much more time is required for healing in the average compound fracture than in the closed case. In one of the cases given here I believe the non-union to be due to marked contusion and separation of the soft parts.

As regards *interposition of fascia and soft tissue*, Campbell[2] in a series of 76 cases did not find this condition in a single instance.

Fig. 2. Case II.

TREATMENT

I do not believe it is necessary to consider here the procedure of freshening the ends of the bone and the use of mechanical

apparatus such as wire, metal plates, nails and kangaroo tendon, since this procedure is no longer considered of any value in the treatment of non-union; nor is it necessary to mention the advantage of autogenous over heterogenous grafts, and I speak of intramedullary grafts only to condemn them, for, in spite of the fact that the material used may be autogenous, we are placing cortical bone in the intramedullary canal where cortical bone is abnormal. It is too frequently absorbed with non-union present; after its absorption, fixation is not complete. The destruction in the intramedullary canal, in my opinion, interferes with union in many cases, rather than aids it. You will notice that this method had been used in one of my cases; the material used, however, was beef bone, and no union had occurred one year after its use. Union occurred very readily after the removal of this peg and the application of an autogenous graft.

Fig. 3. Case III.

Osteoperiosteal grafts I have found of value when used in conjunction with Hibbs' spinal fusion in children, but I have had no experience with this method in the treatment of non-union. However, I feel that in the consideration of a bone graft an important part of its virtue lies in the property of internal fixation.

Fig. 4. Case IV.

Inlay Graft. In view of Dr. Albee's and others' excellent results with this method, I hesitate to give preference to the onlay, or massive graft. The latter, however, I feel is the more suitable in my hands, because

1. There is less interference with the involved bone.
2. There is adequate fixation.

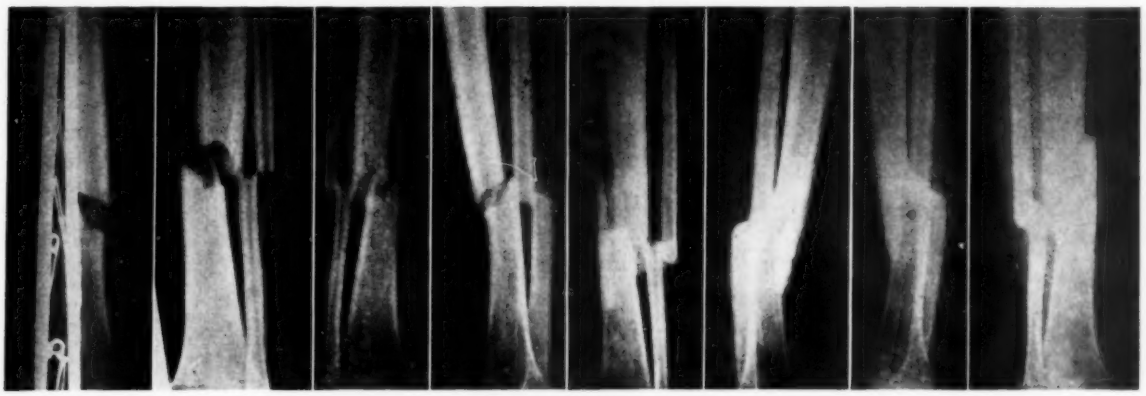

Fig. 5. Case. v.

3. A graft of this type contains all of the bone elements, and is taken from an uninvolved area.

Ghormley and Stuck[3] found by animal experimentation that periosteal transplants in old animals do not produce new bone. Cortical transplants do not completely die, but unite slowly with the bone of their host, and decreased calcification is seen roentgenographically at the end of three months. Cancellous bone unites more quickly and more firmly whether taken from the cancellous bone of the ilium or from the endosteum of the tibia. It gives evidence of increased calcification roentgenographically at the end of three months. It would, therefore, seem expedient to include the endosteum in transplants.

The technique of bone graft need not be discussed, and I shall only say that those of us attempting to carry on this type of work who are not associated with large clinics, or who are unable to command a corps of well-trained assistants, find that we must vary our technique somewhat from that used by those who are more fortunate. For instance, I have used only kangaroo tendon for fixation of the grafts, whereas I would much prefer to use autogenous pegs, but find that it is impossible to do so without unduly endangering the patient by prolonging the operation. I take my grafts high on the tibia, as recommended by Dr. Campbell, and place about the freshened ends of the fragments several curettefuls of material from the intramedullary canal.

CASE REPORTS

Case i. L. D. had an open reduction more than one year prior to my examination. An intramedullary beef-bone peg had been introduced. This peg was removed and an onlay graft applied. Clinical union was present at the end of two months.

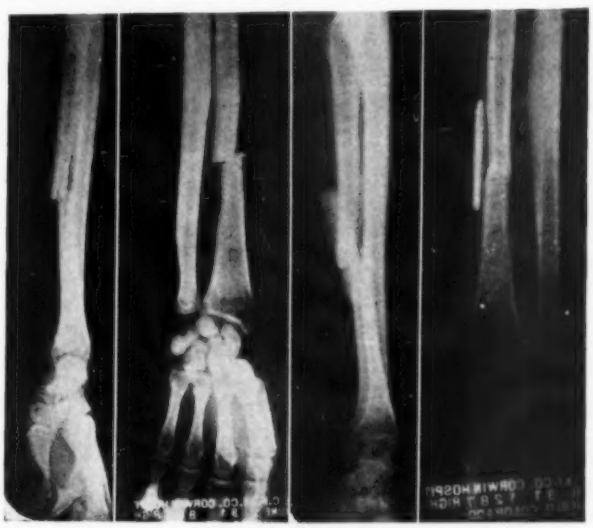

Fig. 6. Case vi.

Case ii. T. B. had a compound fracture treated by the writer, using plaster fixation. No evidence of union was seen after five months. A bone graft was used with clinical union in four months.

Case iii. H. P. suffered a severely compounded comminuted fracture of the upper third of the tibia. He was seen one day after

injury. No union was present after six and one-half months. A bone graft inserted April 4, 1934, resulted in firm union July 18, 1934. The apparent cause of non-union was destruction of the soft tissues.

Case IV. M. I. was seen six months after a simple fracture of the femur which had been treated by skeletal traction. On reviewing the *x*-rays we observed overtraction. An onlay graft procedure was done June 10, 1934, and the cast removed after four months; union, clinically and by *x*-ray, was evident.

Case V. H. W. was seen five and one-half months after simple fracture of both bones of the leg above the ankle. Old films showed overtraction. An onlay graft was used. There was some slipping of the graft. However, firm union occurred after four months and clinical results were satisfactory in spite of the slipping.

Case VI. H. F. was seen two and one-half months after an open reduction in which kangaroo tendon had been used to approximate the ends of the bone. Union was present two and one-half months after an onlay graft.

CONCLUSIONS

Two important causes of non-union are overtraction and separation of the bone from the soft tissues.

Cancellous bone has been shown by animal experimentation to be of considerable importance in bone production.

Internal fixation is an important part of bone graft.

Full thickness onlay grafts are the most satisfactory type of grafts.

REFERENCES

1. Albee, F. H. The autogenous bone graft in the treatment of non-union of fractures. *Internat. J. Med. & Surg.*, 45: 209 (May) 1932.
   Henderson, M. S. Non-union in fractures. *J. A. M. A.*, 81: No. 6 (Aug. 11) 1923.
2. Campbell, W. C. Ununited fractures. *Arch. Surg.*, 8: 782 (May) 1924.
3. Ghormley, R. K., and Stuck, G. W. Study of experimental bone transplantation with special reference to the fact of decalcification. *Proc. Staff Meet. Mayo Clin.*, 8: 253 (April 26), 1933.

REFERENCES OF DR. KING'S ARTICLE*

1. Johnson, L. W. Observation on head injuries. Am. J. Surg., n.s. 27: 518 (March) 1935.
2. Riddoch, G. Discussion on diagnosis and treatment of acute head injuries. *Proc. Roy. Soc. Med.*, 25: 735 (March) 1932.
3. Jefferson, G. Discussion on diagnosis and treatment of acute head injuries. *Proc. Roy. Soc. Med.*, 25: 735 (March) 1932.
4. Dandy, W. E. Diagnosis and treatment of injuries of head. *J. A. M. A.*, 101: 772 (Sept.) 1933.
5. Jackson, H., Kutsunai, T., Leader, L. O., and Joseph, L. D. Effect of hypertonic dextrose solutions on intracranial pressure in acute cranial injuries. *J. A. M. A.*, 100: 731 (March) 1933.
6. Weed, L. H., and McKibben, P. S. Pressure changes in the cerebrospinal fluid following intravenous injection of solutions of various concentrations. *Am. J. Physiol.*, 48: 512 (May) 1919.
7. Hoff, H. Experimentelle Studien zur Frage des post komnotiellen Hernoderns. *Ztschr. f. d. Ges. Neurol. u. Psych.*, 129: 283, 1930.
8. Ernst, M. Untersuchungen über die Wirkung anisotonischer Losungen auf Gehirn und Liquor. *Deutsche Ztschr. f. Chir.*, 226: 222, 1930.
9. Massermann, J. H. Effects of intravenous administration of hypertonic solutions of dextrose. *J. A. M. A.*, 102: 2085 (June) '34.
10. Horrax, G. Head injuries and some of their complications. Am. J. Surg., n.s. 18: 15 (Oct.) 1932.
11. Sharpe, W. Repeated lumbar punctures of spinal drainage. *J. A. M. A.*, 104: 959 (March) 1935.
12. Munro, D. Diagnosis, treatment and immediate prognosis of cerebral trauma; an introductory study of 1494 cases. *New England J. Med.*, 210: 287 (Feb.) 1934.
13. Jackson, H. The management of acute cranial injuries by the early, exact determination of intracranial pressure and its relief by lumbar drainage. *Surg. Gynec. Obst.*, 34: 494 (April) 1922.
14. Jackson, H. The circulation of the cerebrospinal fluid; its importance in acute cranial injury. *J. A. M. A.*, 79, 1394 (Oct.) 1922.
15. Patel and Leclerc. *Progres. med.*, 22: 1997 (June) 1933. Abstr. in Year Book of Surgery, 1934.
16. Russell, R. Discussion on diagnosis and treatment of acute head injuries. *Proc. Roy. Soc. Med.*, 25, 735 (March) 1932.
17. Dandy, W. E. Avertin anesthesia in neurologic surgery. *J. A. M. A.*, 96: 1860 (May) 1931.

*Continued from p. 91.

RELATIONSHIP OF OSTEOCHONDRITIS DISSECANS TO TRAUMA

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SINCE König's classical description of the condition which he designated as osteochondritis dissecans, a voluminous literature has appeared which has failed to add materially to our knowledge, particularly as regards etiology. One therefore hesitates to add to this literature. The following case, however, seems to point so definitely to one specific injury followed, after a reasonable time interval, by a train of signs and symptoms typical of osteochondritis dissecans, that it may furnish important evidence as to the cause (or one of the causes) of this interesting condition.

FIG. 1. FIG. 2. FIG. 3.

FIG. 1. January 15, 1934. Left knee.
FIG. 2. Right knee radiographically negative.
FIG. 3. September 22, 1934. Left knee.

V. E. G., male, aged twenty-one years, was referred to The Guthrie Clinic January 15, 1934 for examination of the left knee.

Chief Complaint: The left knee was weak and occasionally tended to give way when the heel came in contact with the ground first. No pain or locking was noted.

Past History: Not pertinent.

Present Illness: On September 27, 1933, while engaged in pulling stumps with a tractor, the patient received a severe blow over the inner aspect of the left knee. He was confined to bed for one week with a swollen painful left knee. An *x*-ray taken three weeks after the injury was negative. He then returned to work and has worked most of the time since. His family physician examined him on October 31, 1933 and found the left knee considerably enlarged.

Physical Examination: The patient was a healthy appearing adult male who walked with a normal gait. General physical examination was essentially negative. Skeletal examination showed gross atrophy above and below the left knee. The inner condyle appeared enlarged. Motion was painless. Full extension

was possible. Flexion was limited by about 15 degrees as compared to the right side. There was no abnormal lateral or antero-

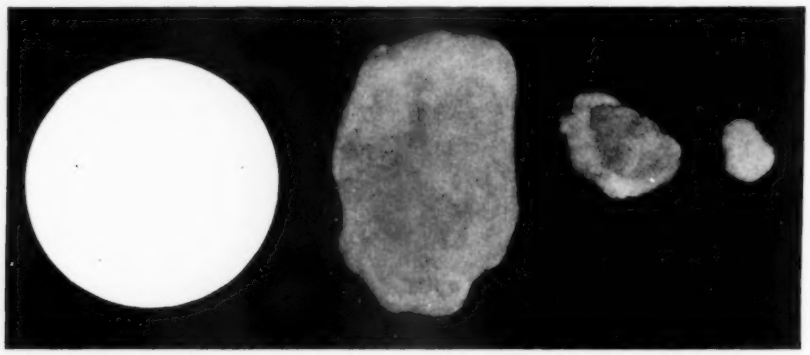

FIG. 4. Foreign bodies removed at operation. Blank is size of 50¢ piece.

posterior motion. Fluid was not increased. No tenderness over the fat pad or anterior attachment of the semilunar cartilages was noted. Slight diffuse tenderness was observed over the internal condyle when the knee was flexed. Measurements above and below the joint showed 1 inch atrophy.

X-ray Examination: The right knee was radiographically negative. The left knee contained a small area of lessened density on the articular surface of both femoral condyles. No foreign body was visualized.

Diagnosis: "Slumbering" osteochondritis dissecans.

Recommendation: No treatment was advised. The patient was informed that the condition might subside spontaneously or symptoms of locking might supervene, which would necessitate operation for removal of the foreign body.

The patient returned to the Clinic on March 28, 1935. He stated that during the preceding several weeks the knee had locked on various occasions, causing him to fall. He also noticed a freely movable loose body in the knee joint about the circumference of a walnut, but appearing to be much thinner.

The latter fact was confirmed on examination and arthrotomy advised.

Operation: The skin was prepared with merthiolate. A tourniquet was applied. The usual curved incision was made over the border of the patella, centering at the joint line. The incision was carried downward through the capsule and synovial lining. Blunt retractors were inserted into the joint. A large defect on the articular surface of the outer condyle of the femur and a smaller one on the inner condyle were present. The crucial ligaments were intact. The spines of the tibia did not seem to be particularly enlarged. The semilunar cartilages were normal. There was found to be an oval cartilaginous foreign body lying in the previously noted defect but not attached to it. A large bean-shaped cartilaginous foreign body was found in the suprapatellar pouch and two small ones of similar constitution were likewise found. The wound was closed in the usual manner. A compression bandage was applied and then a posterior plaster mold.

The postoperative course was uneventful. The patient returned to work at the end of the sixth week.

COMMENT

The records of 10 cases of typical osteochondritis dissecans seen within the past four years were examined with particular reference to a history of injury. This small series comprised two hip (one bilateral), five knee, and three elbow cases. No convincing evidence of trauma as a direct cause was found. In the case presented, however, the relation between injury and the onset of the condition appears clear cut.

SUMMARY

1. A case of osteochondritis dissecans involving the knee is reported in which there is strong presumptive evidence of a specific trauma producing the condition.

2. The case differs from the typical case in that two articular defects are present and neither tibial spine is enlarged.

3. An examination of the records of 10 additional cases fails to establish any relationship between a specific injury and the disease.

MARCH FOOT*

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MARCH foot is an edematous painful swelling of the forefoot associated with an insidious and often unrecognized fracture of one of the metatarsals. It is the direct result of the prolonged and excessive use of weak feet. The condition is most frequently found among marching troops.

The earliest cases were reported by the military surgeons. Breithaupt[1] in 1855 described cases of persistently edematous feet which occurred insidiously and without evident trauma in soldiers subjected to long marches. He called the condition *Fusageschwulst*. Thiele[2] later reported 17 cases occurring in one battalion in three and a half months. Among the French observers Pauzat[3] described march foot as early as 1887 under the title *pied force*. Our real understanding of the condition came with the advent of the *x*-ray. Only then could we visualize the metatarsal fracture and exuberant callus.

The English literature is quite recent and rather scanty. Sir Robert Jones[4] mentioned the condition in his "Orthopedic Surgery of Injuries." Murk Jansen[5] offered a very plausible theory as to the rôle of the interossei in the etiology of the condition. Cases among civilians began to make their appearance. Goldman[6] described a case in a traveling salesman who walked a great deal. Straus[7] reported a case in an obese young woman thirty years of age who was advised to have her leg amputated because of a "sarcoma" which turned out to be the exuberant callus of a march foot. Speed and Blake[8] reported a series of cases among trained nurses, housewives, and business agents who had to be on their feet a great deal. The following case comes under the latter category.

CASE REPORT

H. M., white male, aged thirty-five, occupation salesman.

On March 13, 1935 the patient slipped and fell down a flight of stairs. He is not quite certain as to the details of the accident. When seen the very next day there was puffiness and marked tenderness over the left second metatarsal shaft. Both of his feet were in very bad condition. The longitudinal and transverse arches were flat, and there was bilateral hallux valgus as well as overlapping of the toes. (Fig. 1.) For the past three years he had worn Whitman plates because of his flat feet.

X-ray examination (Fig. 2) revealed a slight periosteal fuzziness on the medial aspect of the second metatarsal shaft but no sign whatsoever of any fracture. The patient's forefoot was supported by strapping and he was allowed to be up and about; although he did not resume his regular work.

Five weeks later he was *x*-rayed again (Fig. 3) and found to have a very definite fracture of the second metatarsal shaft with the formation of exuberant callus about the fracture line. Palpation over the shaft of the bone revealed a very hard, bony mass which was the callus overgrowth.

Further treatment along the same supportive lines and physiotherapy led to a gradual and complete recovery.

CLINICAL FEATURES

There is usually no history of direct injury because the condition is the product

* Read at the Hospital for Joint Diseases.

of the many small traumata that result from excessive walking. What the patient believes to be the precipitating factor may

FIG. 1. General appearance of patient's feet. Note bunions and overlapping toes. Circular area pointed out is site of greatest tenderness and location of callus mass.

very often be discounted. Our patient gave a definite history of having fallen down a flight of stairs, but why was there merely a periostitis and *not* a fracture in the immediate *x*-ray?

The outstanding clinical sign is a painful swelling of the forefoot in a flat-footed person who walks a great deal. The shaft of the involved metatarsal is very tender to direct pressure. Only the second, third or fourth metatarsals are involved; never the first and fifth. It is rare for more than one metatarsal on the same side to be involved. Speed and Blake[8] reported one case in their series in which the second and third metatarsals were simultaneously involved. They regarded this as most unusual.

The condition does not fully incapacitate the patient and he painfully limps about his work. Nature tries to protect the fracture ends by the formation of exuberant callus. This results in the formation of a hard tumor-like mass which appears at the site of the fracture. If the patient is seen for the first time at this stage the mass may be mistaken for a bone tumor. Straus[7] reported a case in a young woman who had been advised to have her leg amputated for a supposed sarcoma of the second metatarsal. *X*-rays showed a dense, bony mass but no definite fracture line. To settle the matter he excised the second metatarsal and the "sarcoma" turned out to be nothing more than exuberant callus. When the second *x*-ray was taken five weeks after our patient was first seen he had already developed a definite mass of exuberant callus which could be felt through the skin over the middle of the second metatarsal bone. In Figure 3 the area outlined by a circle is the site of the callus mass. It was also the site of the greatest tenderness at the first examination. Note also the general poor condition of his feet.

In all these cases there is severe static foot trouble which acts as a definite predisposing factor. Flat feet cause secondary disturbance of local foot circulation, and this leads to increased brittleness of the bones with a tendency to easy fracture or the development of march foot.

X-RAY CHANGES

The *x*-ray appearance of the metatarsals varies with the stage in which the film is taken. Briefly there is the following sequence:

1. No bone changes very early.
2. Periosteal fuzziness after approximately a week.
3. Exuberant callus appears after about three weeks; fracture line quite definite.
4. Fracture heals; exuberant callus is absorbed, and after about six months all that remains is a residual thickening of the cortex at the site of fracture.

PATHOGENESIS

March foot is the direct result of the multiple traumata produced by pounding about on flat feet. The circulation of flat feet is notoriously poor. Added to this we have a protective spasm of the interrosei muscles which further decreases the blood

supply to the metatarsals by compressing the perforating vessels. The metatarsals become brittle and crack under the strain of excessive walking. The continuation of this excessive walking results in the formation of exuberant callus which attempts to splint the broken fragments. When given a chance to heal the bone ends readily unite and the callus is absorbed.

Fig. 2.

Fig. 3.

Fig. 2. Early *x*-ray of left foot taken March 14, 1935. Arrow points to region of periosteal fuzziness. No callus or fracture line as yet.

Fig. 3. *X*-ray taken five weeks later. Note exuberant callus about shaft of second metatarsal. Arrow points to level of fracture line.

TREATMENT

March foot is treated the same as any other fracture of the metatarsal without displacement. The ideal treatment consists of rest and no weight-bearing. As a rule, however, the patient is very reluctant to keep entirely off his feet, so we must resort to the use of strapping or foot plates. Physiotherapy in the form of diathermy or baking is of definite value. In all these cases we must not neglect to treat the flat feet that are always present. It may be advisable to order a change to a more sedentary occupation in the very severe cases.

SUMMARY

March foot is an insidious type of fracture of the three middle metatarsals caused by an excessive pounding on an already weakened flat foot. A protective spasm of the interossei develops and causes a local anemia of the bones, which eventually fracture spontaneously. The patient is unaware of his fracture and continues to walk or limp about. Nature splints the fracture by forming exuberant callus. This forms a hard palpable tumor around the shaft of the metatarsal which may be mistaken for a sarcoma. Treatment in the form of bed rest or even firm strapping results in healing of the fracture and absorption of the callus.

[For references see p. 171.]

TRAUMATIC MEDIASTINAL HEMORRHAGE

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THE mediastinal structures are effectively protected from injury by their position in the middle of the bony cage of the chest. The sternum in front, the vertebral column behind, and the pleural cavities crated by the ribs, on either side, provide security for the highly important structures which occupy the mediastinal spaces. The rare references in the literature to traumatic hemorrhage of the mediastinum deal with direct injuries, as fractures of the thoracic vertebrae[1] or penetrating wounds.[2] The case reported here is unusual in that mediastinal hemorrhage resulted from indirect trauma due to severe lateral compression of the chest.

The patient, R. R., a Mexican laborer, aged forty-six, was assisting in the placing of two heavy metal tanks, each weighing about 14 tons. He was standing beside the one already in position, when the chain being used to lower the second down an inclined runway, broke, and he was crushed sideways between the two tanks. Consciousness was lost temporarily, while jacks were used to extricate him, but was regained before he was entirely liberated. He was brought to the hospital immediately.

When admitted to the hospital, about one hour after the injury, the patient was in fairly good general condition. There was moderate shock. Respiration was difficult and labored. The pulse was slow and regular, 72 beats per minute. Blood pressure was 108/74. Cyanosis was not marked, although the patient's dusky color made its estimation difficult. There was extensive hemorrhage of the bulbar conjunctivae of both eyes, particularly the left, although there was no evidence of external trauma to the region. The right side of the face was swollen. Pain, tenderness, deformity and crepitation indicated fracture at the junction of the middle and outer thirds of the left clavicle. There were no petechiae of the chest, and no "traumatic cyanosis." Swelling of the right upper chest, anteriorly, was present, but no subcutaneous emphysema. No dullness, friction rubs or impairment of breath sounds were elicited.

Immediate portable *x*-ray examination, supplemented by complete roentgenological study of the chest, revealed comminuted fracture of the acromial end of the left clavicle, fractures of both first and second ribs, near the vertebral borders, and longitudinal fracture of the superior portion of the spine of the right scapula. The mediastinal shadow was markedly widened, and, in lateral view, the superior and middle mediastina were obliterated. Routine Wassermann test was found to be positive. A diagnosis of lateral crushing of the chest was made, resulting in fractures of both first and second ribs, left clavicle and right scapula, with mediastinal hemorrhage.

Treatment was conservative and symptomatic, and was directed, first, toward the control of shock. The patient was kept sitting almost upright. An oxygen tent was held in readiness, but its use was not indicated by increasing cyanosis or dyspnea. The blood pressure rose gradually to 140/90, and the pulse became somewhat more rapid. The temperature rose to 100.2°F. on the day after the injury, and then gradually returned to normal. The patient made an uninterrupted recovery, and was discharged from the hospital in good condition one month after admittance. *X*-ray observation revealed gradual absorption of the mediastinal hemorrhage, with residual increase in breadth and density of the right

[1] Eiselsberg, A., and Gold, E. Ueber das paravertebrale intramediastinale Haematom bei Wirbelbruechen. *Deutsch. Ztschr. f. Chir.*, 233: 329, 1931.

[2] Horn, H. Bemerkenswerte Fall einer Stichverletzung der Art. mammaria intern. sin. mit groszem Mediastinalhaematom. *Zentralb. f. Chir.*, 57: 2550, 1930.

hilus shadow from organization of the hematoma. The patient has returned to work, and apparently has made a complete clinical recovery.

Fig. 1. *X*-ray of chest showing marked increase in mediastinal shadow due to hematoma.

Fig. 2. Re-examination three weeks later reveals absorption of hematoma with return to normal contours.

SUMMARY

A case is presented of severe lateral compression of the chest, with fractures of both first and second ribs, left clavicle and right scapula. Conjunctival hemorrhages resulted from the thoracic squeezing, and hemorrhage occurred in the superior and middle mediastina. The patient made a good recovery, without demonstrable permanent impairment. He will be observed over a long period of time for late sequelae resulting from the trauma.

REFERENCES OF DRS. SLOANE AND SLOANE*

1. Breithaupt. Zur Pathologie des Menschlichen Fusses. *Med. Ztschr.*, 24: 169, 1855 (quoted from Speed and Blake).
2. Thiele. Ueber Frakturen der Metatarsalknocken durch indirecte Gewalt. *Deutsche med. Wchnschr.*, 25: 158, 1899 (quoted from Speed and Blake).
3. Pauzat, J. E. De la penostite osteoplasique des metatarsien a la suite des marches. *Arch. de med. et de pharm. milit.*, 10: 337, 1887 (quoted from Goldman).
4. Jones, R. Orthopedic Surgery of Injuries. London Oxford, 1921, 1: 88.
5. Jansen, M. March foot. *J. Bone & Joint Surg.*, 8: 262 (April) 1926.
6. Goldman, S. E. March foot with fracture of metatarsal bone. *J. Bone & Joint Surg.*, 10: 228 (April) 1928.
7. Straus, F. H. Marching fractures of metatarsal bones. *Surg. Gynec. Obst.*, 54: 581 (March) 1932.
8. Speed, J. S., and Blake, T. H. March foot. *J. Bone & Joint Surg.*, 15: 372 (April) 1933.

*Continued from p. 169.

ECTOPIA VESICAE, IMPERFORATE RECTUM AND ANUS TRUE HERMAPHRODITISM AND OTHER ANOMALIES

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THE following case is reported because of its anatomical and surgical interest. Cases have been referred to in the literature of congenital anomalies which bore some similarity to this most unusual case, but thorough perusal of the medical literature fails to reveal a published description of one.

This patient had ectopia vesicae, imperforate rectum and anus, true hermaphroditism and other congenital anomalies. Congenital malformations of the bladder are not common; those most frequent are associated with inadequate development of the abdominal wall by which prolapse of the bladder (exstrophy) occurs.[11]

Exstrophy of the bladder presents many varied types and may occur in either sex, although it is considered more common in males. The condition was described as early as the seventeenth century and was then considered a hernia of the intact and open bladder through the abdominal wall. The correct interpretation of the lesion was given by Devilleneuve[6] in 1769; thirteen years later the term exstrophy was first applied to the condition by Chaussier.[3] According to Neudorffer[12] and others, it occurs only once in 50,000 births, and approximately 90 per cent of the children thus affected perish in infancy.

Anomalies of the urinary bladder are uncommon, the most frequent malformation met with being extroversion of the bladder in varying forms. My own case is a combination of several.

In this case of ectopia vesicae, the anatomical picture was represented by a deficient bladder without an anterior abdominal wall, the trigonum bearing the ureteral openings, the posterior wall present, the umbilicus absent, the pubic bones not united at the symphysis, the pelvis shallow but wider than normal.

In the abdominal area, 10.5 cm. above the symphysis, the abdominal wall was wanting, and in its place there was a projecting ovoid mass 9 × 10.5 cm. of highly inflamed mucous membrane in which could be seen the openings of the ureters, placed moderately low and constantly ejecting urine. At the upper left superior margin of this ovoid mass, attached by a wide and thick pedicle, was a normal sized scrotum, for the patient's age, with the testes absent. At the middle right margin of the scrotum was a rudimentary penis, about 5 cm. in length, partly devoid of the urethra. At the lower margin of this ovoid mass in the midline of the perineum was a small fistulous opening discharging liquid feces. (Figs. 2 and 4A.)

There was a constant dribbling of urine from the ureteral openings, and liquid feces from the fistulous opening in the perineum. Consequently, the posterior bladder wall and surrounding skin, especially the inner surfaces of the thighs, were chronically inflamed. The patient was constantly compelled to wear a wire shield over this ovoid mass to prevent clothing from coming in direct contact with it.

Malformations, abnormalities and deficiencies of the lower end of the gastrointestinal tube were first noted and written of by the ancients. One of the first and most authoritative classifications of the different forms is that of Von Papendorf[16] in 1781. Bodenhamer,[1] in our own country, added another chapter to the thorough understanding of the subject in 1860; and many others have since made contributions. Congenital malformations of the rectum and anus are rare, occurring on an

average of only once in about 1500 births. No two seem to be identical in their physical characteristics, though fundamentally

Fig. 1. Roentgenogram showing dilatation of imperforate rectum, separation of pubic bones and metal disc (penny) in rectum.

they are all variations of the embryological plan of development. The most common in this group is the imperforate anus.[5]

The rectum and anal canal develop from entirely different embryonic layers, the rectum from mesoblast and hypoblast and the anal canal from the epiblast. Malformations of either the rectum or anus are very likely to be associated with malformations in other parts of the body which are derived from the same layer of the blastoderm.[2] In this case there was a complete absence of the anus, but no pigmentation or bulging of the perineal skin. There was, however, a very small shallow dimple or depression of the skin at what would be the normal site of the anus in the perineum. (Fig. 3A.) The abnormal anal fistula opened at a point at the lower margin of the ovoid mass in the midline of the perineum. (Figs. 2, 3A and 4A.)

The rectum ended at a point about 6.5 cm. above the perineum. The rectum was distended with feces and at the lowest anterior margin was a fistulous tract, with

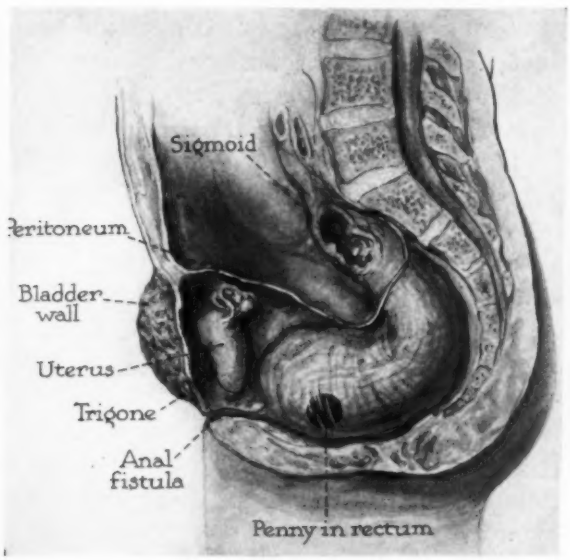

Fig. 2. Lateral section.

very small lumen, 7.5 cm. in length, directed upward and forward, ending in the perineum. Injecting the fistulous tract and examining with the fluoroscope, revealed this deformity. (Fig. 2.)

A barium meal was not administered to the patient before *x*-ray pictures were taken, as we thought it might complicate matters. After the *x*-ray pictures were taken, the examination revealed a separation of the pubic bones at the symphysis. The imperforate rectum was greatly distended with feces, and much to our surprise there appeared at the terminal end of the rectum a round metal disc. (Figs. 1 and 2.) This disc acted as a guide and was helpful in the operative procedure that followed. A history obtained from the mother of the child assured us that the metal disc was a penny swallowed by the patient many months previous.

This brings up a point for future cases: whether we should hesitate to allow a child of this age to swallow a small metal disc or ball to show the terminal limits of the rectum and act as a guide in the operative procedure. I would not advise this method for the extremely young, but would suggest

the use of air, buttermilk or barium before *x*-ray pictures are taken, as suggested by Rhodes.[13]

Preoperative Preparation. Gauze packs saturated with boracic acid solution were placed over the ovoid mass and continuously moistened to produce a field as aseptic as possible. The inflammation subsided in the course of two weeks, and to our surprise the weight of the moist packs pressed the posterior bladder wall and trigonum downward and backward; it was believed that an autoplastic operation[14] could be performed, utilizing the scrotum to form a roof over the posterior bladder wall. (Fig. 4.)

CASE REPORT

A. M., white male child, aged four years, well-developed and nourished. The patient was cheerful and very bright, and answered questions intelligently; he was apparently normal, except for the congenital defects present. The patient had about all the habits that are normal for a boy of his age, and in addition did like to cut out paper dolls. The parents had postponed any surgical operations for correction of the congenital defects, as they had been informed by several physicians that the defects could not be corrected and that it would be only a matter of time before the child would die. The parents were much concerned about the child's condition, and finally consented to send the patient to the Springfield City Hospital for examination, operation and treatment.

Chief Complaint: Exstrophy of the bladder, imperforate rectum and anus and other congenital anomalies.

Past History: He had had the usual diseases of childhood, and recently had scarlatina. There was no history of rheumatism. The general health had been good.

Family History: The mother and father were living and well. One brother and one sister were living and well. There were no deformities or congenital defects in the other members of the family.

Physical Examination: The head was well-shaped. There was some widening of the frontal bone (Fig. 5). The pupils were equal and reacted to light and accommodation, the sclera was clear, and all ocular movements were normal. Ears and nose were normal. The teeth were in fairly good condition, several out. The tonsils were not diseased. He had a mild pharyngitis. The neck was well formed, with no enlargement of the thyroid or cervical glands, and neck movements normal. The chest was well formed. The nipples were in normal position, with no enlargement of the breasts. The lungs revealed equal expansion on both sides. There was no increase in vocal fremitus, no dullness on percussion, no râles except a few in the right supraclavicular region. Breath sounds were normal. Heart: P.M.I. apparently in normal position. On percussion there was no enlargement. There were no murmurs; the heart sounds being apparently normal in rate and rhythm. The apex beat was heard in the fifth left interspace, nipple line.

The abdomen was rather large and distended, but soft (Fig. 5). There were no palpable masses or tenderness except around the margins of the exstrophied bladder. The umbilicus was absent. At the lower region of the abdomen was an ovoid deformity, measuring 9×10.5 cm. At the upper left margin of this ovoid mass was the dislocated scrotum, of normal size for a boy four years of age. The scrotum was attached by a wide and thick pedicle, the testes absent. Midway at the right margin of the scrotum was a dislocated rudimentary penis about 5 cm. in length, partly devoid of the urethra. (Fig. 4A.) At the lower or inferior margin of ovoid mass in the midline was a perineal fistula discharging a brown liquid of fecal odor. At a point above the lower margin of the ovoid mass in the bladder wall were two minute ureteral openings ejecting urine. The ureteral openings and perineal fistula kept the surfaces bathed continuously with urine and feces so it was impossible to keep the surfaces clean. The perineum was smooth and no anus was present. There was no blueness or bulging of perineal skin. No inguinal or femoral hernias were present. On palpation in the right inguinal region a very small soft mass, believed to be an undescended testicle, was found; there was no evidence of a similar condition on the left side. The ovoid exstrophied bladder wall was highly inflamed and bled at the slightest touching or rubbing of the membrane. The patient wore a metal wire shield over the ovoid mass to prevent the clothing from coming in direct contact.

The pelvis was unusually wide, as were also the hips. (Fig. 5.) The pubic bones could be

palpated as separated in the midline. (Fig. 1.) Extremities and joints were normal. The patient had a peculiar waddling or "duck-like"

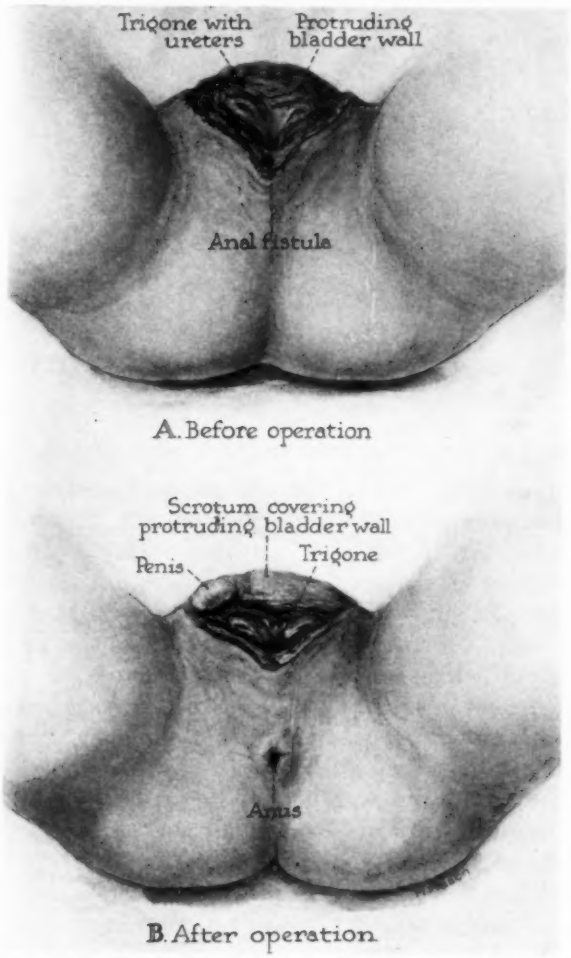

Fig. 3. Perineal view before and after operation for imperforate anus.

gait and the feet were everted. The skin showed no eruptions and no defects, except at the lower part of the abdominal wall. There was an eczema and slight excoriation of the skin on the inner aspect of the thighs, irritated by urine and feces. The glands showed no palpable enlargement. Reflexes were normal.

Temperature was 98.4°F., pulse 96, respirations 24. Urinalysis was negative. Blood examination was practically normal. Wassermann and Kahn reactions were negative.

Roentgenological Findings: Apparently there was absence of the pubic arch. No bone was in evidence between the ischia. An opaque, elliptical density of metal was visualized in the lower right pelvic region. The metal disc was in the rectum which was evidently distended with gas and feces.

Urological Report: The ureters were catheterized; no calculi were present. The upper end of the ureteral catheters was on a level with the

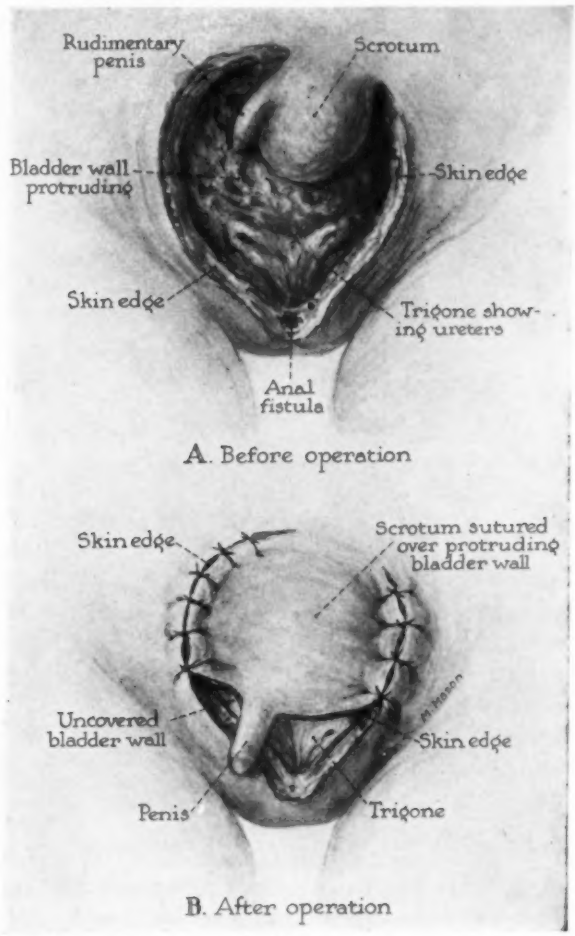

Fig. 4. Front view before and after operation.

last lumbar vertebra beyond the limits of the bladder. It was suggested that another *x*-ray be taken after injecting the ureters and kidneys.

First Operation: Autoplastic repair of exstrophied bladder and correction of malformations: imperforate rectum, anus and perineal fecal fistula.

The operation by steps was as follows: First, the skin edge at the upper margin of the ovoid mass was dissected free from above downward on both sides for about 7 cm., then the pedicle of the scrotum was dissected free, except for about one-third of its attachment on the left side, thus allowing the scrotum to be ironed out. The edges of the scrotum were then sutured to the edges of the skin on the right and left sides, thus forming a roof on the anterior wall almost covering the posterior wall of the bladder, except a narrow transverse space at the lower

margin of the ovoid mass. (Fig. 4B.) A piece of rubber dam was placed between the posterior wall of the bladder and the mucous membrane

Fig. 5. Front view. End-results after operations.

of the scrotum to prevent immediate contact. This was removed in five days. Healing by first intention seemed possible, but after a week there was a separation of the scrotal and skin edges at the lower and middle margins on both sides. This step of the operation caused the ovoid mass to become smaller, as the measurements before operation were 9 × 10.5 cm., and after the operation the same measurements were 5 × 6.5 cm. (Fig. 4.)

This part of the operation completed, the second step was to correct the malformation of imperforate rectum, anus and the perineal fecal fistula. (Fig. 3.) A straight median incision was made, just anterior to the shallow dimple in the skin of the perineum, and extended backward about 5 cm. The incision passed through the skin and subcutaneous tissue, the muscle fibers were separated by blunt dissection, introducing a clamp and spreading the jaws to widen the opening through the muscle sufficiently to allow the introduction of the index finger. The index finger was introduced and carefully inserted for a distance of 6 cm.; fortunately the rectum was encountered, dilated with feces. The tip of the finger was swept

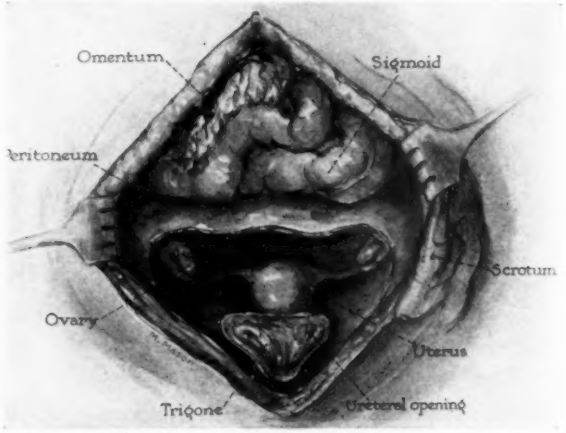

Fig. 6. Showing arrangement of pelvic content.

around the end of the rectum and the metal disc was palpated. The peritoneum, attached rather low down, was cautiously freed and the rectum was then brought down to the skin incision but was not entirely free of all attachments. I was then able to palpate the fecal fistula which was holding the rectum up at the anterior surface. The fecal fistula was grasped with two forceps and divided between them, the stumps tied and carbolized. The stump at the rectal end was held by a clamp, and was then drawn down and delivered easily through the skin incision and anchored by four interrupted chromic catgut sutures to the surrounding muscle. The rectum was incised at the point of the rectal fistula stump, this being excised. On opening the rectum there was some escape of gas but very little feces.

The edges of the opened bowel were sutured in all its layers to the surrounding skin edge, with interrupted black silk. The bowel contents were then removed, including a quantity of rather hard and soft fecal masses and the copper penny. A rubber tube 2 cm. in diameter was inserted into the rectum, and anchored by one suture to the skin edge and allowed to protrude 4 cm., beyond the anal suture line to prevent soiling the operative field. The perineal fecal fistulous stump was treated as in an appendectomy, ligated, cut, carbolized with phenol and dropped. Several days following the operation the rubber tube was removed. The incision at the anal margin healed by first intention without any infection. In the course of a week the patient had good sphincteric control and the bowels moved once or twice a day.

This operation corrected one annoying condition, in that it relieved the constant discharge of liquid feces through the perineal opening of the fecal fistula. The patient had an uneventful convalescence.

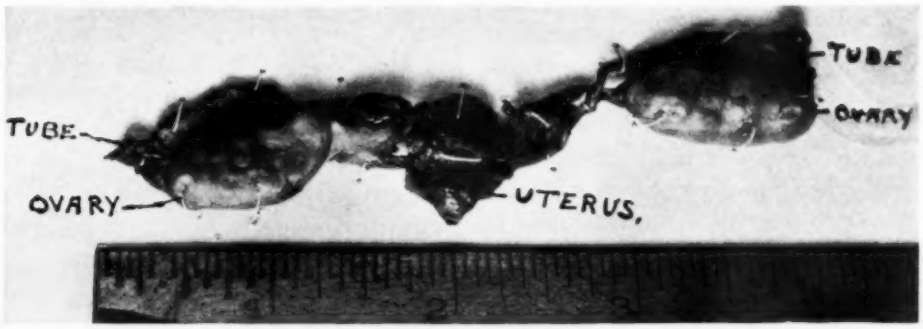

Fig. 7. Removed uterus, tubes and ovaries.

Second Operation: Plastic repair (two months later). The separated edges of skin and scrotum at the middle and lower margins on each side were re-sutured and healed by first intention. This step at least prevented doing an extensive skin graft operation later on. The perineal opening of the fistula and the fistulous tract was dissected free and excised.

Third Operation (four years later): Excision of posterior bladder wall; supravaginal hysterectomy; bilateral salpingo-oophorectomy; ureterorectal transplantation; and abdominal plastic operation.

Both ureteral orifices of the exstrophied bladder were catheterized and the free ends of the catheters placed some distance from the field of operation, allowing the urine to flow unobstructed. The right margin of skin and scrotal edges were dissected free from above downward and retracted upward and to the left. The abdomen was opened at the junction of the skin and vesical defect. Through this opening two fingers of the left hand were inserted into the peritoneal cavity. They served as a guide during the continuation of the incision through the margin of the bladder throughout the circumference of the defect to the lowest point below the trigone, thus separating the bladder from the abdominal wall. The excess bladder wall was cut away from the ureteral orifices, leaving them opening upon an island of bladder tissue with section of trigone, of oval outline, the axis of oval being transverse, following Maydl's technique.[9] The abdominal section was continued upward in the median line in order to expose the sigmoid. It was impossible to utilize the sigmoid in any manner for ureterosigmoidal transplantation without a kinking of the low-placed ureters, so this field was abandoned.

The organs of the peritoneal cavity on hasty examination did not reveal any pathological condition. I was able to palpate a small undescended testicle in the right inguinal canal, but a thorough search did not reveal a testicle on the left side.

The posterior excess bladder wall was removed; behind the trigone was a small vaginal pouch, without external outlet (Fig. 6) measuring 2.5×4 cm.; at the superior margin of this vaginal pouch was a small pear-shaped mass proving to be a rudimentary uterus and projecting from either side were tubes and ovaries, which were removed. (Fig. 7.) There was not any prostatic tissue seen or any evidence of an urachus or umbilicus.

The ureterotrigonal transplant was placed in a position without the ureters being kinked and it was seen that in so doing a ureterorectal instead of a ureterosigmoidal transplantation was required as in Maydl's[9] or the Coffey[4] and Mayo[10] operation, and the transplantation would be extraperitoneal. The rectum was manipulated by intestinal clamps, with the neighboring field protected by gauze, and brought into a convenient position for ureterotrigonal rectal transplantation.

A longitudinal incision was made in the peritoneum covering the anterior lateral wall of the rectum, the edges of the peritoneum were retracted transversely and then Moynihan's modification of the Maydl technique used. A section of the trigone with ureteral orifices was dissected free, then a curved clamp was passed into the rectum and through the incision in the anterolateral wall.

The ureteral catheters were withdrawn and the mucous membrane of the trigone with the terminal ends of the ureters was seized with a

clamp and drawn into the rectum. After completing this step the peritoneum was then sutured over the implantation, care being taken not to constrict the ureters. There was very little bleeding throughout the entire operation. One rubber dam drain was inserted in the rectovesical space close to the site of the ureteral implantation and brought out through the skin at the lower angle of the incision. The peritoneum was then deflected downward and sutured to the lower edge of the vesical mucosa at the skin edge. The abdominal incision was closed, using plain catgut in the peritoneum, chromic catgut in the muscle and fascia, and black silk in the skin.

The right margin of the scrotum was resutured to the right skin margin at the lower angle of the abdominal incision, closing the area where the exstrophied bladder wall was excised. This step placed the rudimentary penis almost in its normal position, which I believe to be an original idea.

A dressing of gauze was used to cover the incision and to prevent any soiling. A piece of rubber tissue was placed over the gauze dressing and held in place by liquid adhesive plaster.

The convalescence was slightly prolonged, but the patient made a good recovery, and was discharged from the hospital in very good condition several weeks later.

This was a case of true hermaphroditism, with masculine external and feminine internal genitalia. The patient had an undescended testicle in the right inguinal canal, but none in the left.[15]

Postoperative Notes: The first notice of urine passing from the anus was the day following the ureterorectal implantation. There was some drainage from the lower angle of the abdominal incision for a period of two weeks after removal of the drain. Two weeks after operation the patient was comparatively comfortable and was able to retain urine in the rectum for from four to six hours without any anal leakage.

There was some sluggishness in the healing at the lower angle of the incision for a period of one month. The patient completed his convalescence and was discharged from the hospital some weeks later. (Fig. 5.)

The patient was examined at irregular intervals for three and one-half years, during which time he did not develop any pyelitis and his general condition remained good.

SUMMARY

It is my belief that most congenital defects can be benefited by some surgical procedure.

The operations performed on this patient improved both his mental and physical condition. His general attitude was entirely changed. He had been tutored at home and was never able to attend a public school until after his third operation. The child then assumed boyish mannerisms very noticeable from year to year, after his pitiable condition was corrected, and he was able to associate with other children.

The author desires to express his sincere appreciation to Dr. E. R. Brubaker, roentgenologist, and Dr. N. L. Burrell, urologist, of Springfield, Ohio, and Miss Marion Mason, artist, Chicago, for their valuable assistance.

REFERENCES

1. Bodenhamer. Quoted by W. W. Keen.[8]
2. Bryant, J. D., and Buck, A. H. Amer. Pract. Surg. N. Y., Wood, 1911, 7: 774.
3. Chaussier. Quoted by Guiteras, R. Urology. N. Y., Appleton, 1912, 2: 8.
4. Coffey, R. C. Quoted by Walters, W. Am. J. Surg., 24: 776–792 (June) 1934.
5. David, V. C. Nelson's Loose Leaf Living Surg. N. Y., Nelson, 5: 161, 1928.
6. Devilleneuve. Quoted by Guiteras, R. Urology. N. Y., Appleton, 1912, 2: 8.
7. Gant, S. G. Diseases of Rectum and Anus. Phila., Davis, 1908.
8. Keen, W. W. Surgery. Phila., Saunders, 1914, 4: 117.
9. Maydl. *Wien. med. Wchnschr.*, 44: 1113; 1209; 1256; 1297, 1894 and 46: 1241; 1333; 1373, 1896.
10. Mayo, C. H. Quoted by Walters, W. Am. J. Surg., 24: 776–792 (June) 1934.
11. McFarland, J. Pathology. Phila., Saunders, 1908, 754.
12. Neudorffer. Quoted by Guiteras, R. Urology. N. Y., Appleton, 1912, 2: 9.
13. Rhodes, R. L. Am. J. Surg., 14: 828 (June) 1934.
14. Roux. Quoted by Guiteras, R. Urology. N. Y., Appleton, 1912, 4: 12.
15. Wharton, L. R. Congenital defects. In: Lewis, D. Practice of Surgery. Hagerstown, Prior, 1928, Chap. 2, 10: 23–29.
16. Von Papendorf. Quoted by W. W. Keen.[8]

LYMPHOSARCOMA OF THE STOMACH

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SARCOMATA make up only 1 per cent of stomach malignancies. The reported cases have been studied very carefully by a number of men. In 1930 D'Aunoy and Zoeller reported 4 cases and collected and piled from the literature 335 cases. However, only 100 of these were studied from a histologic standpoint; of this 100 only 39 were lymphosarcomata. Thus, it might be properly estimated that somewhat more than one-third of the sarcomata of the stomach are of the lymphosarcomatous type. In 1930 Balfour and McCann added 37 cases to those already collected by D'Aunoy and Zoeller. A total of 381 cases of sarcoma of the stomach had been reported up to 1932.

A case which we have recently seen is of sufficient rarity and interest to warrant reporting:

V. L. W., a white male, twenty-two years of age.

The chief complaint was pain in the abdomen associated with gas, the pain being more severe when the stomach was empty. For the past two months the pains were as previously noted but more severe. Recently night pain had developed, relieved by belching or taking soft foods. There had been a 10 pound weight loss because of inability to take foods. The bowels were regular and in general the patient said he felt well except for weakness.

Physical Examination: He was a poorly nourished young man, weighing 129 pounds. The reflexes were normal; the tonsils were large but not infected; the teeth were in good condition; no glands were palpable in the neck. Examination of the heart was normal. Blood pressure was 120/80; pulse 92; temperature 98.6°F. The lungs were normal. There was a large movable mass in the left upper quadrant.

Laboratory Findings: The blood Wassermann reaction was negative; hemoglobin 85 per cent; R.B.C. 4,010,000; W.B.C. 5200; the blood differential count was within normal limits. The urine examination was negative.

Gastric analysis showed free HCl to be 2, and total acids 28. There was no blood in the gastric content.

X-ray examination revealed a large ulcerating growth involving the lower two-thirds of the stomach. The operability was doubtful.

Operation: Exploration through a high left rectus incision revealed a huge growth involving the lower two-thirds of the stomach, about the size of a large cantaloupe. The peritoneum was involved and the transverse mesocolon was involved so that it was impossible to save the transverse colon. I made out no distant metastasis. One large gland near the cardia was removed and reported to be inflammatory. About four-fifths of his stomach together with the transverse mesocolon and transverse colon was removed and the operation completed as a Balfour-Polya procedure with entero-anastomosis. The colon was resected over a Rankin clamp and the loops of bowel brought out through the mid-incision. The whole thing seemed to work out very well. One large drain was left down to the pancreas, one small iodoform drain was left around the colostomy and a catheter was put in the proximal loop of the colostomy to allow gas to escape. The operative risk was estimated to be 25 per cent.

There was no postoperative shock and the patient did well for the first five days. At that time a duodenal fistula developed, associated with a good deal of distention. There was also evidence of broncho-pneumonia at the right base. There was very little change in his condition for the next few days. It appeared at times that he would get well. His death came eighteen days postoperative and was due to a combination of the foregoing causes. A post-mortem examination was not granted.

All types of sarcoma may be seen in the stomach. They usually occur earlier in life than carcinoma, but at the same time they

FIG. 1. Resected growth with attached omentum and transverse colon.

may occur at any age. The oldest patient whose case has been reported is Di Giacoma's, aged ninety-one. Hunt reported on the youngest patient, a child three years of age. This case was treated successfully by sub-total gastrectomy. Only 5 per cent of the patients have been under twenty years of age.

The symptoms are those of gastric malignancy. A definite diagnosis cannot be made without histologic examination. Most of the growths have been diagnosed preoperatively as chronic ulcer or carcinoma.

The case herein reported is not only interesting because of the rarity of the condition but because of the size. It is quite unusual for any malignancy to attain such a huge size without involving adjacent organs by metastasis. In this case the growth had involved the transverse colon and transverse mesocolon by continuity, so that it was necessary to remove these structures in order to completely remove the growth. Although the growth looked

FIG. 2. Completed operation. Growth has been removed and anastomosis established by Balfour-Polya technique. Ends of colon were brought up into incision over a Rankin clamp.

inoperable by fluoroscopy, it proved to be easily resectable. This further emphasizes the point that in malignancies of the stomach, if there are no evidences of metastasis, the patient is entitled to exploration, for not uncommonly a growth is found to be removable even though it looks inoperable from the *x*-ray findings. The indications of gastric resection combined with colonic resection do not present themselves very often. As a usual thing, when the growth has involved both organs it is beyond cure because of distant metastasis or attachment to adjoining irremovable organs. A combined resection was our patient's only chance of cure.

We are encouraged in regard to prognosis in some of these cases, consequently are willing to accept considerable risk. A patient operated upon by Bunts at the age of nine, and living and well nineteen years later, further illustrates the adequacy of gastric resection for some of these malignancies and encourages us to continue with radical procedures.

SARCOMA OF THE UTERUS

WITH REPORT OF CASE OF SARCOMA BOTRYOIDES

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SARCOMA of the uterus is much less frequent than carcinoma. According to Zacherl,[1] carcinoma outnumbers sarcoma by 40 to 1, and Evans[2] reported 22 sarcomata and 873 carcinomata in studies of the statistics of the Mayo Clinic from 1910 to 1919. Norris[3] concluded that carcinomata are from 20 to 50 times as frequent as sarcomata of the uterus.

Uterine sarcomata are relatively more frequent in early life than carcinomata. Sarcoma botryoides is occasionally seen in infants and young girls. However, most sarcomata develop at from thirty-five to fifty years of age. Lynch reported a case of sarcoma of the uterus in a woman seventy years of age.

Sarcomata may be classified into those originating from the endometrium and the myometrium. The most frequent variety is that originating in fibroids, although occasionally they originate primarily in the musculature of the uterus and cervix. Some authorities feel that this transition from fibroids to sarcoma is rare, while others think that sarcoma develops in 10 per cent of fibroids. The frequency with which sarcomata are found in fibroids is in proportion to the care with which they are sectioned. If every fibroid tumor was carefully sectioned, a much larger percentage of sarcomata would be found than if the examination was made more superficially. Winter[4] reported 4.3 per cent sarcomatous change in 352 fibroid tumors which were systematically examined.

Sarcoma also arises from the mucosa of the uterine body and from the mucosa of the cervix. The former is usually a large, soft tumor which extends into the uterine muscle and sometimes into the peritoneum. At other times it is a large polypoid tumor which fills the uterine cavity and extends through the cervical os, as a large sloughing, bleeding mass.

The more common form of sarcoma arises from the cervical mucosa and is named sarcoma botryoides, first described by Spiegelberg. It is a growth occurring in infants and small children and less commonly in adults, is extremely malignant, and grows very rapidly. It begins as a group of small polypoid tumors which rapidly multiply until the growth protrudes from the cervix, fills the vagina, and may protrude from the vulvar orifice. As a result of erosion and infection, hemorrhage and necrosis are common complications.

SYMPTOMS AND CLINICAL COURSE

The chief symptoms of uterine sarcoma are pain, hemorrhage, discharge, and pressure symptoms. The pain is more marked in the rapidly growing variety or when the cervical canal is blocked by the growth. It also results, in later stages, from extension of the growth to surrounding tissues. Hemorrhage may appear as a constant flow, of a moderate quantity, or may be of great amount. When hemorrhage is absent the discharge is usually thin, very offensive and very irritating. Pressure symptoms are marked in the later stages by obstinate constipation, dysuria or urinary retention.

PROGNOSIS

The prognosis of uterine sarcoma depends on the type of tumor, and the rapidity with which it is growing. If panhysterectomy can be performed before the extension of the tumor to the surrounding tissues, complete cure has been reported. The mucosal types are especially malignant.

TREATMENT

Authorities differ as to the treatment, although most recommend radical surgery if the case is found in the early stages. Some authorities recommend large doses of radium inserted into the uterus, and postoperative high voltage *x*-ray treatments for at least two years. Bonney[5] urges early operation for all fibroids of the uterus before malignant changes take place.

REPORT OF CASE

The patient was a widow, sixty-four years of age, with four children, and was first seen April 15, 1933, complaining of a bloody discharge and pain upon urination. Vaginal examination revealed that the uterus was somewhat larger than normal, but upon speculum examination the cervix appeared normal. There was no bleeding from the uterus at the time of the examination. She had a large vascular caruncle which I thought was the source of the bleeding. I therefore fulgerated it, and saw her at weekly intervals for postoperative treatment. On May 15 she complained of a return of the bleeding and a feeling of fullness in the vagina, and at that time I repeated the vaginal examination. To my surprise I found that the vagina was filled with soft, round pearly tumors apparently attached to the cervix. Examination provoked considerable hemorrhage, so it was impossible to get a good view of the cervix. One of the grape-like tumors was removed and was sectioned by Dr. C. B. McGlumphy, who reported as follows:

"Microscopic examination shows the tumor to be composed of cells with practically no intercellular substance. The cells vary in form, some being round, some definitely spindle-shaped, and others are irregular in outline and of relatively large size. In some areas the cells have apparently become necrotic, presenting an intercellular area which takes a pink stain. There are many areas of hemorrhage between the tumor cells in which the outlines of red corpuscles are readily recognized. The rather numerous blood vessels show no definite wall, but in most cases appear to be channels between the cell masses. Generally the cell area surrounding the vascular spaces are best preserved while those more distant show evidence of cell degeneration. The sections represent a sarcoma of the mixed cell type."

Her chief symptoms at that time were bloody, irritating vaginal discharge and a feeling of fullness in the vagina. On account of her advanced age and her poor general physical condition, and the extension of the growth around the cervix, a panhysterectomy was considered inadvisable, and radium therapy was recommended. She refused radium treatment, so her symptoms were treated palliatively. She was kept under close observation from that time until her death eight months later. The tumors appeared in crops every four or five weeks, growing rapidly and completely filling the vagina. In a few days they would become necrotic and slough away. Then, for a couple of weeks the patient was relatively free from symptoms.

Each successive attack grew gradually worse, and her strength slowly failed. The uterus became larger and more fixed, and the infiltration about the cervix increased. Two weeks before her death mental symptoms appeared, consisting chiefly of poor memory, disorientation, and speech disturbance. These symptoms persisted about a week and were followed by gradually deepening coma, and death from exhaustion.

COMMENT

This was undoubtedly a typical case of sarcoma botryoides and illustrates the extremely malignant nature of the growth. It is doubtful whether any active treatment would have been entirely successful, although it is probable that large doses of radium in the cervix might have lengthened her life. Unfortunately, she had several friends upon whom radium had been used for advanced uterine malignancy with prolongation of painful existence. This fact led to her refusal of radium therapy, although I explained to her that in her case the results would probably have been quite different.

[For References see p. 188.]

NEW INSTRUMENTS

LAMINECTOMY SHEAR

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TO every surgeon who is called upon, whether occasionally or frequently, to perform the operation of laminectomy, the need for improved methods of sectioning the bony laminae over those now in use must be apparent. In some instances it is possible, with instruments commonly used for the purpose, to accomplish this step with comparative ease and celerity. In others, its accomplishment may be so difficult as materially to protract the time required for the operation.

FIG. 1. Author's laminectomy shear.

These considerations supplied the incentive for the development of the instrument to be described. This instrument (Fig. 1) has a cutting blade of sufficient length to traverse the widest lamina and, opposite the blade, a guard, so constructed that it may be inserted, without endangering the contents of the canal, beneath the laminae at any point of the vertebral column. The lamina is severed quickly and cleanly, first on one side and then on the other (Fig. 2). The arch can then be removed by merely lifting it with forceps. This step in the operation is thus materially simplified, and the time required for its performance materially shortened.

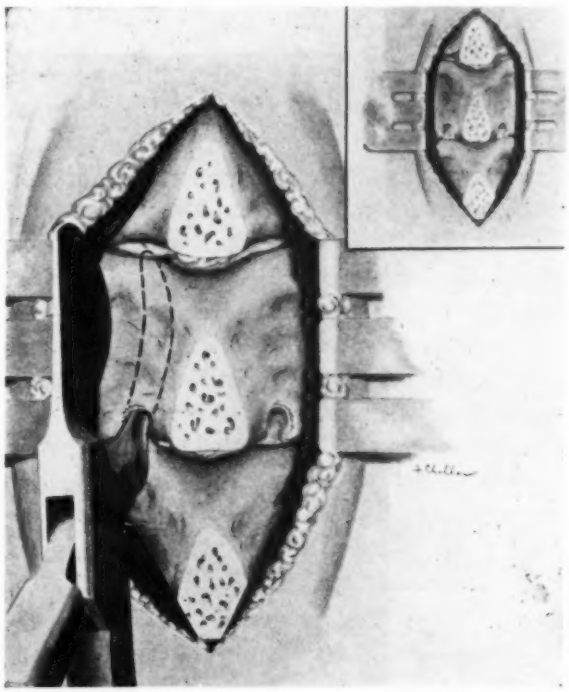

FIG. 2. Method of inserting guard beneath lamina. Guard is sufficiently small and so shaped as not to endanger contents of canal. Insert shows notches made with rongeur to facilitate insertion of shears.

In some instances, the laminae lie so closely together as to make it difficult to insert the guard of the shear beneath the lamina with a rongeur (Insert, Fig. 2). The guard can then be inserted through this opening.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

A NAVAJO MEDICINE SING*

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THE history of early American medicine is very difficult to discover. This is due to the fact that most of the Amerinds left no written or pictorial record of their lore or practices and those who did, left it in forms which we are as yet entirely unable to read or translate. When our scholars shall have found a method by which the coptics, sculptured and painted records which they have left us may be translated, we shall probably find that early American medicine had as much of value to give us as we have received from any other primitive source.

Perhaps some ignorant of early American history may feel that this is an overstatement, but a little contemporary study will soon show that the people who have given us digitalis, cocaine, quinine, belladona, cascara, aloes, a host of diuretics, diaphoretics and untold drugs of like value had a medical history well worth our study. It is reasonable to suppose that such a race had something worth our recognition, a people who devised symphiosiotomy, cesarian section, amputations, who used artificial extremities after injury or loss, who were well able to reduce dislocations and set fractures long before a freebooting Italian on a lost Spanish ship blundered on this western hemisphere.

One method of study of ancient American medicine still exists, one which should receive more attention from our historians and which still offers a rich reward to the student. It is through the study of the traditional practices which are still in vogue among our more advanced tribes. Tradition in the medicine clans and practices, we have reason to believe, are still very carefully carried out and the accuracy of its transmission has been demonstrated time and again in archeological research.

This past summer I had the opportunity to witness a medicine sing, given by a colleague of ours. I met this man and was allowed to attend parts of the ceremony through the courtesy of Mr. Ramon Hubble, of Ganado, Arizona.

The patient was a young Navajo matron of about nineteen years. She had been delivered of a healthy male infant about nine months before the date of the sing, but

* Read at the 11th Annual Meeting of the American Association of the History of Medicine, Atlantic City.

had failed to make a good recovery thereafter, though she was still nursing her child at the time of the ceremony of which I wish to speak. She had been taken by her husband and father, both intelligent and respected members of the tribe, to a mission clinic in the neighborhood where she was hospitalized for a week or so, and where, therefore, a satisfactory examination and history of the case was obtained. She ran an almost constant night temperature, profuse sweats, poor appetite, and a constant racking productive cough. Tubercle bacilli were found in the sputum and the chest showed abundant signs and the *x*-ray picture of a progressive chronic ulcerative tuberculosis. She had also a widespread tuberculous lymphadenitis.

Naturally she had not prospered while she was in the mission hospital, notwithstanding the fact that she was treated with all the skill and care possible and though she seemed quite content there. Since little could be promised by the white physicians the relatives decided to resort to Indian measures.

A council of the old members of the community was called and a decision was made as to the character of treatment which seemed most desirable and as to the practitioner who should be called. This medicine man enjoyed an excellent reputation in the group both because of his successes and because of his high personal character. He lived about forty miles from the hogan of his new patient. He required two or three days to collect drugs and the ceremonial objects necessary for the treatment. The conference also decided as to the fee to be paid for the service.

After he had collected the necessary drugs and ceremonial objects, several of which were only to be secured at considerable cost in time and money, he arrived at the hogan of the patient's father where he took up his home for the five days to be devoted to the ceremony.

I did not see the beginning of the sing, but I was told that it was introduced by the taking of an emetic by the medicine man, and by those others including the patient who were to take part in the ceremony. Mr. Hubble, who is much revered and respected by all the natives in that community where he has lived his entire lifetime, took an active part in this introduction. A small altar had been constructed immediately to the west of the hogan, just in front of the door flap which naturally faced to the west. The ceremony began at sunset when proper prayers were addressed to the sun.

The treatment proper was introduced by the medicine man singing the designated songs, occasionally dancing about the tepee circle near the center of which the patient and her mother were seated on a ceremonial blanket. All the persons in the hogan were required to strip to the waist for all those in the hogan took part in the ceremony, even the three little children, when they were not asleep.

A carefully tended fire, evidently of ceremonial significance, was kept burning just below the smoke hole. At times the singing of the priest was joined in by the whole party, at times only by the patient and throughout the ceremony almost as much attention was given to the mother of the girl as to the patient herself. At intervals a ceremonial bowl was passed about the circle, each taking a drink of its contents, the priest first, then the patient, her mother, and clockwise around the circle of the hogan group. The mixture contained broken-up fragments of sage brush of some specific variety, with bits of the needles of the pinon pine, of wild hemlock and what else I cannot say, bruised up in water, which had been ceremonially collected. It had a very bitter taste and was both emetic and actively diuretic. Persons taking part in the ceremony occasionally adjourned outside the hogan for the demonstration of the action of this medicine.

The first night's treatment terminated at about 2:00 A.M. when a sort of sociable was held with plenty of food, tobacco, etc. The little patient with her young husband then went off to their hogan and the others

to their various homes in the little family group.

The second evening was introduced in much the same manner, but this time only the patient and her mother were stripped to the waist, the rest of us, with the exception of the priest, wore our ordinary clothing. We were provided with little wands of eagle feathers with rattles and the like with which we imitated the movements of the priest at certain periods of the ceremony. The bowl of bitters circulated at frequent intervals.

The ceremonial blanket on which the patient and her mother sat was frequently taken up, carefully brushed out of doors, refolded and replaced.

On this evening most of the singing was done by the priest, but occasionally all in the hogan took part, and the singing was at times distinctly in parts. The words used by the bystanders often differed from those of the priest. They were mostly monotonous repetitions so that we were able to take part in a sort of way. At a signal from the medicine man we dipped our eagle wands in the ash of the fire, and after waving them up and down, from side to side in rhythm to the singing and to the occasional pat of the priest's drum, finally blew the ash from the feathers in the direction of the smoke hole. Also occasionally the medicine man would pass about the circle dusting first the patient and her mother, then the rest of us with sacred corn meal and, rarely, with a tiny pinch of pollen.

Now and then the priest would dance about the circle of guests in the hogan, striking us on the head with his eagle wand, meantime continuing his chant, but for the greater part he sat by the side of the patient or her mother chanting and occasionally anointing them with sacred water, corn meal or pollen on the breast, the forehead and down the flexor surfaces of the arms, down the thighs, and especially rubbing and massage of the feet was frequently repeated.

The priest was attended by a student acolyte and by two other men, one of whom was the patient's father. At about ten thirty the ceremony concluded with a little smoke fest during which the patient passed among us smiling and shaking hands, as did her mother also.

The next day was spent by the priest and his assistants in the collection of tufts of pine and of the yellow sage which was then in flower. A great deal was done in the way of preparation. That evening the ceremony was much the same as on the previous night and, as before, the persons in the hogan circle took part in a decorous way. After the priest had danced about the hogan circle tapping the heads of all with his eagle feather wand, the door blanket was turned aside and he ceremoniously waved out of the hogan door with a fan of eagle feathers, the same fanning was directed toward the smoke hole and the meaning was evidently the driving out of the hogan of unfavorable spirits or influences.

All was conducted with the utmost dignity and decorum, but between the songs and ceremonies while the priest was resting the rest of us smoked, talked and joked. The patient took her infant son, suckled it, crooning and playing with it in a most unaffected manner. The children of the family by now were mostly asleep, but frequently wakened to take part for a few moments in a childish imitation of the ceremonies.

The maintenance of the fire appeared to be an important part of the ceremony; it was directed by the priest, who ordered it replenished from time to time and green sage brush was piled on it occasionally apparently for the purpose of producing a heavy smoke. He would frequently dip up ash from the fire and sprinkle it on the head and chest of the patient and her mother. At about half-hour intervals the blanket on which the patient and her mother were seated was taken up, covered with the ash, corn meal and tufts of twigs to be carried out of the hogan to be cleansed of the debris and returned again for the patient to sit upon.

The priest would frequently consult his medicine bag, and bring out objects for use, including a bone whistle which he used in one of his dances.

About the middle of the ceremony the patient was completely covered with tufts of sage, pine, pinon and cedar, gathered into small bundles tied with some sort of fiber and her face was completely covered by a mask of twigs with a circular crown of upright bunches of twigs, from which projected a crown of eagle feathers, a most picturesque figure. After a very beautiful song sung by the priest and the chorus, attendants slowly clipped away the tufts of twigs, the small bundles falling on the blanket almost rhythmically, the blanket was then carefully folded and taken out of the hogan to be again emptied.

The bowl again made the rounds, the patient finally bathing her feet, hands, legs, arms and chest with the remaining fluid, using the masses of twigs as a sponge. Another short song, a brief dance before the patient by the priest, then the medicine man advanced to the center of the circle just below the smoke hole, waving upwards with his wand of feathers and uttering with great dignity and authority ejaculations or commands that the bad spirits still remaining in the hogan be forced out through the smoke hole, and the sing was over for the night.

The next morning under the direction of the priest the acolytes made a very beautiful sand painting in the center of which the patient sat during the ceremonies as of the succeeding night. A second beautiful but smaller painting was made just in front of her and at the conclusion of that night's ceremonies the sand of the paintings was carefully swept up into a ceremonial blanket and carried far out on the desert where it was spread to the winds. The dances and songs were little like those of the preceding night.

During the afternoon of the fifth day another sand painting was made, on which the patient again sat. The afternoon was chiefly taken up by a very impressive recitation by the priest, interrupted with repetitions of the formula by the patient in but slightly modified form, just as in the litany of the episcopal church. Each formula was repeated four times and there were sixteen of them. As near as my friend could tell me, they were orders for the disease and all manner of trouble to quit the hogan forthwith and finally. This was concluded by the passing about of a small bag of pollen; with this the patient first anointed herself, then it was passed about the circle, each person in the hogan taking a small pinch, crossing himself, concluding the gesture by throwing a very little up toward the smoke hole. She then arose from her seat, shook the dust on the sand painting which was immediately scraped up into the blanket and carried out. She then walked about the hogan circle, shaking hands and saying a few words to each of us, smiling, and passing out of the door flap, went back to her own hogan and her baby. She particularly thanked a young doctor of the hospital who had had charge of her while she had been there and expressed her pleasure that he had come to the sing.

She doubtless lay down to rest after these exacting ceremonies, and particularly because of the fact that the ceremonies of that night were to last from sun down to sun up. These I did not attend, for I did not feel like spending the entire night in that way, the singing and rhythmic dancing making me very sleepy, but the priest said that the ceremonies would be very like those I had witnessed, but with different songs. I saw the young lady a few days later and she told me most politely that she was feeling very much better and she hoped that I was feeling better, too, for the sing is supposed to do everybody who takes part in it much good, physically and spiritually. Anyway my friends insisted that it had done us all a lot of good.

Throughout the ceremony was dramatic, solemn, and in no way amusing. It was

conducted with all dignity and seriousness. Not only is the patient supposed to benefit from this ceremony, but all the friends and relatives also are supposed to be purified and improved. Gifts are in order for the general good which has been accomplished. The sing cost the family about $40.00 in goats, sheep and other goods.

The medicine man was a fine-looking, dignified old fellow; he was at all times most sincere and serious in his attitude, at times in the ardor of the singing or dancing his neck veins would stand out and he was covered with sweat. He was dressed and undressed in ceremonial articles, his eyes would bulge with the intensity of his efforts and he impressed me as a devoted, honest and entirely sincere man. The spell which he cast on all of us was very much like that of a great actor or singer, and his sincerity was obvious.

I had a few minutes of conversation with him. He said he was glad that I had come and hoped that I might come to other of his sings. I told him that I thought that he had earned his money by a great deal harder work than I did. He laughed, and with a rougish grin said, through the interpreter, that he not only worked much harder but that he did a lot more good for the money too!

In addition to Mr. Hubble and myself, Dr. Miller of the local hospital and a great favorite with the Navajo people attended the ceremony. Mrs. Ickes and Dr. Sexton of Washington, known friends of the Navajo, were also present at one of the ceremonies. All of us felt impressed with the dignity of the performance, but sorry for the sweet-tempered and long-suffering little patient. I saw her several times afterwards about the reservation. She always greeted me with a happy smile and told me how much better she was. She looked it.

REFERENCES OF DR. VISHER*

1. A.: Nelson'sZACHERL. Quoted by Schumann, E. Loose Leaf Living Surgery, 7: 240.
2. EVANS, N. Malignant myomata and related tumors of uterus. *Surg. Gynec. Obst.*, 30: 225, 1920.
3. NORRIS, C. C. Uterine Tumors. N. Y., Harper, 1930, p. 197.
4. WINTER. Quoted by Schumann, E. A.: Nelson's Loose Leaf Living Surgery, 7: 245.
5. BONNEY, V. Cyclopedia of Medicine, 12: 773.

* Continued from p. 182.

BOOK REVIEWS

CLASSICAL CONTRIBUTION TO OBSTETRICS AND GYNECOLOGY. By Herbert Thoms, M.D. With a Foreword by Howard A. Kelly, M.D. Springfield, Ill., Charles C. Thomas, 1935.

This book from the facile pen of Dr. Thoms is sure to interest nearly all obstetricians and gynecologists, as well as physicians interested in the cultural side of the profession.

The author has presented fifty-nine selections from the works of great medical authors whose contributions and discoveries have furnished foundations of knowledge of Obstetrics and Gynecology.

Howard Kelly has done a short foreword in which he writes in the final paragraph: "It is my fond expectation that the work before us will do much to enhance the value of medical history as a background, and impress our students with the dignity of present-day professional acquirements which have so often called for sacrifices even of life itself."

To give one an idea of the book's scope let us look at Chapter 1. It deals with General Obstetrics and we read Soranus of Ephesus' "A Description of the Uterus"; William Harvey (1578–1657) on "The Constitution of the Uterus"; Hendrik van Deventer (1651–1724), "A Description of the Bony Pelvis"; William Hunter (1718–1783), "The Anatomy of the Gravid Uterus"; John Sterns (1770–1848), "The Introduction of Ergot"; Jean Alexandre Lejumeau de Kergaredec (1787–1877), "The Ausculation of the Fetal Heart"; John Braxton Hicks (1823–1897), "On the Contractions of the Uterus Throughout Pregnancy"; Alfred Hegar (1830–1914), "A Positive Symptom for the Diagnosis of Pregnancy in the First Months"; and Adolph Pinard (1844–1934) "On Abdominal Palpation as Applied to Obstetrics."

Chapter 2 is entitled "The Course of Labor." We note Feilding Ould's (1710–1789) "The Mechanism of Labor" and Carl Siegmund Franz Crede's (1819–1892) "The Prophylactic Treatment of Ophthalmia Neonatorum." Other chapters deal with writings on "The Pathology of Pregnancy," "The Operations of Obstetrics" (for instance: Ambroise Paré (1510–1590), "The Reintroduction of Podalic Version"), "Puerperal Infection" (among these Oliver Wendell Holmes' (1809–1894) "The Contagiousness of Puerperal Fever," and Ignaz Phillip Semmelweis (1818–1865) on "The Import of Child-bed Fever"), "Deformities of the Pelvis." The last chapter is devoted to Gynecology and we note, among other articles, those of Ephraim McDowell (1771–1830) "The Operation of Ovariotomy"; James Marion Sims (1813–1883), "The Treatment of Vesico-vaginal Fistula"; Robert Lawson Tait (1845–1899), "The Treatment of Ectopic Pregnancy"; and Emil Oscar Jacob Bruno Noeggerath (1827–1895), "Latent Gonorrhea in Women." In a brief manner this gives one an idea of the field this work covers.

The work is finely illustrated with 57 unusual portraits, facsimiles of title pages, text pages of famous books and reproductions of apparatus.

There is an adequate Bibliography, and an Index of Authors, Subjects, and Book Titles.

I do not know when I have enjoyed reading a book as much as I have this one. A hint to teachers in our medical schools: Have undergraduate students procure this book and assign them to read five to fifteen pages a day. The finest background to the study of obstetrics and gynecology possible!

TUMORS OF THE URINARY BLADDER. By Edwin Beer, M.D., F.A.C.S. With 52 illus. Including 8 in color. Balt., William Wood & Co., 1935.

It goes without saying that anything written pertaining to urology by Edwin Beer has the hall-mark of the highest authority. Here and abroad he has earned a reputation that comes to but few men. This reputation, in part, was earned by his work on urinary bladder tumors. To urologists throughout the civilized world Beer's original work on these tumors is known. And so his only too short (166 pages) monograph on this subject is more than welcome. Naturally, urologists will want this book on their shelves, but the general surgeon and gynecologist will do well, also, to familiarize themselves with this subject.

The author opens his monograph with a chapter entitled "Historical Sketch," and then goes on to discuss such topics as Incidence, Causation, Pathology of Bladder Tumors, Symptoms and Diagnosis, and what is most important a "Consideration of Treatment." A chapter is devoted to a consideration of the technique of transurethral treatment; also, chapters on the suprapubic operation, and extraperitoneal partial resection of the bladder for infiltrating carcinoma. There is a chapter on "Combination of Therapy in More Complicated Cases of Bladder Tumor, Especially Carcinoma." Important! Space is devoted to total cystectomy for carcinoma of the bladder, and a chapter on radiation therapy is included. The book ends with "Summary and Conclusions." There is an ample bibliography and an index.

YEAR BOOK OF RADIOLOGY, 1935 Ed. by Charles A. Waters, M.D., and Ira I. Kaplan, M.D. Chicago, Year Book Publ., Inc., 1935.

This work reviews the leading articles which have been published during the year on Radiology. Diagnosis has been edited by Dr. Waters assisted by Dr. Firor; and Therapeutics has been edited by Dr. Kaplan. Part I deals with Radiological Diagnosis, and Part 2 with Radiotherapeutics. In the part on diagnosis the field has been covered thoroughly. Chapters dealing with the Osseous System, Skull, Sinuses and Mastoid, Soft Tissues, Glandular System (interesting), Respiratory and Cardiovascular Systems, Gastrointestinal Tract, Genitourinary System, Obstetrics and Gynecology, Nervous System and Teaching and Principles of Practice occupy 333 pages. A valuable article by Mr. Hirth on the legal and industrial aspects of silicosis is worthy of careful perusal.

The part on Radiotherapeutics is exceptionally well done and worth the attention of other than Radiologists. Internists and surgeons might well spend some time learning what can be done and by what means for malignancy. The book ends with the consideration of Radiation Injuries and Occupational Cancer.

There is an ample index.

MECHANICS OF NORMAL AND PATHOLOGICAL LOCOMOTION IN MAN. By Arthur Steindler, M.D., F.A.C.S. Springfield, Ill., Charles C. Thomas, 1935.

An excellent book, especially to students of orthopedic surgery and of physical education! We doubt if it will appeal to the average physician.

The author revised the text of his lectures on this subject and this book is the result of such labor. The aim has been to attempt to demonstrate the relation between theoretical analyses and practical interests. The author has avoided lengthy mathematical operations whenever the ultimate formula or equation could be presented in simple terms.

There is an interesting chapter on the history of mechanics of the locomotor system. The first part of the book considers chapters on the General Mechanics of Locomotion. Part 2 deals with Special Mechanics of Locomotion, such as The Spinal Column, Mechanics of the Pelvis, Mechanics of Respiration, The Abdominal Cavity, Mechanics of Posture, Pathomechanics of Scoliosis and Mechanics of the Hip Joint, the Knee Joint, the Ankle and Foot, Shoulder-Arm Complex, Elbow Joint, and Wrist and Fingers. The chapters on The Mechanics of the Human Gait, Graphic Description of the Gait, Pathomechanics of the Gait, and Rationalization of Work in Locomotion are interesting and most instructive. The work is well illustrated and has an ample Subject Index.

We feel this book will be well received by orthopedic surgeons and others interested in the subject. It has been decidedly well done.

OBSTETRICAL PRACTICE. By Alfred C. Beck, M.D. More Than One Thousand Illustrations. The Williams & Wilkins Company, 1935.

On our library shelves we have most of the works on obstetrics published during the past twenty-five years. Some three or four are outstanding. Two are recommended for student use in most of our medical schools. They are excellent. However, in our mature judgement we have felt that the leading text-books on obstetrics, although beautifully illustrated and weighty, are not thoroughly adopted to a student's needs. For a long time we have wished that a book on obstetrics would appear especially constructed for the medical student

and, for the man in general practice who wants to learn the necessary fundamentals. We believe Alfred Beck has met these specifications in his Obstetrical Practice.

For twenty-five years Dr. Beck has been teaching obstetrics to undergraduates, and conducting a large out-patient service where under his supervision students attended women in labor. Having been trained by such eminent men as Reuben Peterson, J. Whitridge Williams, and John O. Polak, his background makes Dr. Beck peculiarly fitted for the task, and he has done a splendid work. We now have a book minus padding, a "hit from the shoulder" book. Every sentence means something. According to the author, "Disproven theories and the conflicting factors which have led to controversy accordingly are not discussed. . . . Especial attention has been given to prenatal care . . . The mechanism of labor has received much consideration . . . The chapter on the toxemias has been as simple as possible . . . Long association with a large general hospital has shown the importance of the medical and surgical complications in obstetrics."

There are over a thousand drawings, the majority being simple line drawings and, in many places, series of illustrations have made possible the elimination of lengthy descriptions. The author made most of the drawings over a ten year period and have been redrawn by an artist with Beck at his shoulder.

The publishers are to be congratulated for publishing profusely illustrated, valuable book of over seven hundred pages, for seven dollars.

The book deserves a large sale. Teachers of obstetrics should know it for they will in turn recommend it to their students. Young practitioners will become better obstetricians from its perusal.

To our way of thinking (and others share this opinion) this book is one of the outstanding recent contributions to medical literature.

Regional Anatomy. By J. C. Hayner, M.D. William Wood & Co., 1935.

The author frankly says there are many worthwhile textbooks on systemic anatomy and, in no way, does he make any pretense that his book contributes any new data. He has deliberately drawn information from the classics on anatomy.

However, as a result of his experiences during twelve years of teaching anatomy, the author feels there is the need of a book which is brief, inclusive and strictly descriptive in form. This book is specially designed for the undergraduate medical student, the recent graduate and the prospective surgeon.

Dr. Hayner has done a creditable work. It is a book, one the graduate is more liable to refer to than to casually read. After reading it we feel any surgeon will do well to possess it. It, at least, offers the anatomical answers, without a loss of time, to the seeker.

A worthwhile text to students of anatomy and to practicing surgeons.

John Whitridge Williams Academic Aspects and Bibliography. By J. Morris Slemons. The Johns Hopkins Press ,1935.

This book of only a hundred and nine pages is worth many times its selling price of $1.50.

Dr. Slemons has presented certain aspects of the life of J. Whitridge Williams in a style which could serve as a pattern for future biographies. At the conclusion of the reading one's feeling is that he wishes there were several hundred more pages. In every way it is delightful. To the hundreds who worked with and knew Williams this gem will have a distinct appeal. Others will marvel at his industry and ideals. Medical school libraries should have a few copies, and senior students should be made to read Dr. Slemons' short classic.

Surgery—Queen of The Arts. William D. Haggard, M.D., F.A.C.S., D.C.L. Foreword by William J. Mayo. Illustrated. W. B. Saunders Company, 1935.

This book is composed of thirty-three addresses and scientific papers by Dr. Haggard which were delivered before national and other societies. The author tells us these were selected from some hundred and fifty contributions which he has made during an active hospital and private practice.

Personally, the reviewer most enjoyed those addresses rendered at the occasions when the author was being made president of an important medical or surgical organization. The opening article, "Surgery, The Queen of the Arts," the inaugural address presented before the Clinical Congress of the American College of Surgeons, is a classic. The story of Ephraim

McDowell is known to most modern physicians, but Haggard tells it in a refreshing and fascinating manner in his "Surgeon of the Wilderness." The Background of the American Surgeon, The Seeds of Time, Abdominal Surgery and the General Practitioner (exceptionally good), The Yellow Plumed Knight of Medicine: William C. Gorgas, What Price Health?, The Romance of Medicine, The Qualifications of the Surgeon, Paul Fitzsimon's Eve, are all engrossing and will be read and reread time and time again.

This book of 390 pages reveals the many sides of one of our profession who has blazed the trail, elevated the standards of medical teaching and practice, and who has earned recognition as one of the foremost surgeons of his time.

In every way Dr. Haggard's book is delightful to read, to ponder, and one which the physician of culture will use as a reference from time to time, as it is a veritable storehouse of information, and there is not a dull line between its covers.

BOOKS RECEIVED

All books received by The American Journal of Surgery are listed in this column as soon as possible after their receipt and this must be considered as adequate acknowledgement. Books that the Editor considers of special interest to our readers will be reviewed in a later issue.

A B C of the Endocrines. By Jennie Gregory, Baltimore, Williams & Wilkins, 1935.

Autonomic Nervous System. By James C. White, New York, Macmillan Co., 1935.

Aphasia—A Clinical and Psychological Study. By Theodore Weisenburg and Katherine B. McBride. New York, Commonwealth Fund, 1935.

Atlas of Pathological Anatomy. By E. K. Martin. Baltimore, Wm. Wood, 1935.

Demonstrations of Physical Signs of Clinical Surgery. By Hamilton Bailey. Baltimore, Wm. Wood, 1935.

Individual Exercises. By George T. Stafford, Harry B. DeCook, and Joseph L. Picard, New York, A. S. Barnes, 1935.

International Clinics, Vol. III and IV. Louis Hamman, Editor. Phila., J. B. Lippincott, 1935.

Localized Rarefying Conditions of Bone. By E. S. J. King. Balti., Wm. Wood, 1935.

Radiology of Bones and Joints. By James F. Brailsford. Balti., Wm. Wood, 1935.

Recent Advances in Laryngology and Otology. By R. Scott Stevenson. Phila., P. Blakiston, 1935.

Russell A. Hibbs—Pioneer in Orthopedic Surgery. By George M. Goodwin, New York, Columbia Univ. Press, 1935.

Terminology of Operations of the University of Chicago Clinics. By Hilger Perry Jenkins. Chicago, Univ. of Chicago Press, 1935.

Treatise on Medical Jurisprudence. By Benton S. Oppenheimer. Balti., Wm. Wood, 1935.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (The American Journal of Surgery, Inc., 49 West 45th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices.*